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EDITED BY

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CONTENTS OF VOLUME II.

Number I.

ORIGINAL COMMUNICATIONS.

PAGE

PROF. A. E. DOLBEAR. On the Number of Vibrations necessary for the Recognition of Pitch. 1

THOMAS ALVA EDISON. A Resonant Tuning-fork.... 3

CLARENCE J. BLAKE, M.D. A Form of Middle-ear Syringe.... 5

URBAN PRITCHARD, M.D., F.R.C.S. A case of Foreign Body in the Ear Producing severe Cerebral Symptoms; Removal and Recovery.... 9

CHARLES HENRY BURNETT, M.D. Uninterrupted Wearing of Cotton Pellets as Artificial Drum-heads.... 14

EDWARD WOAKES, M.D. Further Observations on "Throat Deafness, Associated with Paresis of the Palato-tubal Muscles".... 22

ALBERT H. BUCK, M.D. The Comparative Value of Leeches, Heat, and Incisions in the Treatment of Acute Circumscribed Inflammation of the External Auditory Canal.... 25

CHARLES A. TODD, M.D. A Simple Modification of the Hand-Atomizer.... 35

BOOK NOTICES.

The International Congress of Medical Sciences; Proceedings of the Section of Otology.... 36

A case of Luxation of the Inferior Maxilla above and into the Temporal Fossa. Thèse par *Paul Neis* 40

Forty-seventh Annual Meeting of the British Medical Association; Proceedings of the Subsection of Otology.... 40

REVIEWS.

R. H. M. BOSANQUET, On the Present State of Experimental Acoustics, with Suggestions for the Arrangement of an Acoustic Laboratory, and a Sketch of Research, 45.—E. HOSPITALIER, The Audiometer, 46.—S. THOMPSON, The Pseudophone, 47.—W. KOHLRAUSCH, On the Sensibility of the Organ of Hearing, 48.—A Curious Acoustical Illusion, 48.—M. COLDEFY, The Education of Deaf-Mutes, 48.—An Examination at the Institution for Deaf-Mutes at Passy, 55.—WEBER-LIEL, Communication between the Endo- and Peri-Lymphatic Cavities of the Labyrinth and Extra-Labyrinthine Intra-Cranial Cavities, 56.—HORATIO R. BIGELOW, On the Chorda Tympani Nerve, 58.—A. VULPIAN, Effects upon Secretion and Circulation produced by Faradization of the Nerves Traversing the Tympanic Cavity, 58.—A. DEPRÈS, On the Various Seats of Mucous Patches, but especially the Mucous Patches of the Auditory Canal, 60.—GIOVANNI LONGHI, A Case of Ménière's Disease, 61.—CHARLES J. KIPP, Four Cases of Intra-Cranial Disease, Caused by Chronic Suppuration of the Middle Ear, 62.—DAVID COGGIN, A New Test for Simulated One-sided Deafness, 62.—EDWARD S. ELY, Note on the Treatment of Acute Suppurative Inflammation of the Middle Ear, 63.—LADREIT DE LACHARRIÈRE, The Use of

Mineral Waters in the Treatment of Diseases of the Ear, 63.—AUGUST LUCAE, Report on the Cases of Ear Disease Observed in the University Policlinic of Berlin, 65.—E. CRESSWELL-BABER, On a Possible Source of Error in the Diagnosis of Fungus in the Ear, 66.—CHARLES S. TURNBULL, A Clinical Lecture on Perforating Wounds and Injuries of the Membrana Tympani, with a Case of Fracture of the Handle of the Malleus, 67.—HOLMES, Objective Sounds from the Ears, 68.—KÜHN, Antiseptic Treatment of Certain Diseases of the Ear, 68.—BOGROFF, A New Method of Opening the Mastoid, 69.—DELSTANCHE, A New Instrument for the Removal of Adenoid Vegetations from the Naso-Pharynx, 69.—SAMUEL THEOBALD, The Scepticism Prevalent Regarding the Efficacy of Aural Therapeutics, 70.—VOLTOLINI, Glass Bead in the Ear, 70.—A. HARTMANN, On the Washing out of the Tympanic Cavity and its Recesses, 70.—SCHALLE, An Instrument for Removing Fluids from the Tympanum, 72.—S. MOOS, A Case of Closure of the Auditory Meatus, and Loss of Hearing, by the Formation of Exostoses, Complicated with Acute Perforative Inflammation of the Middle Ear, with Repeatedly Recurring Granulations; Restoration by the Use of Laminaria Rods and the Galvano-Cautery, 72.—S. MOOS, Four Cases of Severe Disease of the Mastoid Process, 73.—GELLÉ, Pulsating Tumors of the Tympanic Cavity, 76.

BIBLIOGRAPHICAL INDEX: Books, 78; Journals, 78. Notes, 80.

Number II.

ORIGINAL COMMUNICATIONS.

PAGE

CLARENCE J. BLAKE, M.D. On the Occurrence of Exostoses within the External Auditory Canal in Prehistoric Man 81

J. ORNE GREEN, M.D. Phlebitis of the Mastoid Emissary Vein, from Phlebitis of the Lateral Sinus.—Death from Pyæmia.—Autopsy 92

E. D. SPEAR, Jr., M.D. Clinical Observations 100

ELIZA M. MOSHER, M.D. A Case of Purulent Inflammation of the Middle Ear 110

SAMUEL SEXTON, M.D. Hearing by the aid of Tissue Conduction—The Mouth-Trumpet and the Audiphone 114

BOOK NOTICES.

Die Krankheiten des Gehörorgans im Kindesalter. VON TROELTSCH: Tübingen, 1880, pp. 144 120

Traité des Corps Étrangers en Chirurgie: Cinquième Partie. Corps Étrangers dans l'Oreille. Par A. POULLET. Paris, 1879 121

Taubstummheit und die Erziehung der Taubstummen. DR. ARTHUR HARTMANN. Berlin, 1880 126

Vocal Physiology and Hygiene. By GORDON HOLMES. Edinburgh, 1879 ... 133

REVIEWS.

SYLVANUS P. THOMPSON, Lecture Experiments in Acoustics, 136.—O. N. ROOD, On a Method of Studying the Reflection of Sound-Waves, 137.—DR. GILLETTE, Otitis in a Tuberculous Subject; Suppuration in the Tympanum; Trepanation of the Mastoid Apophysis; Cure, 138.—M. ASSAKY, Carcinoma of the Middle Ear and Petrous Bone, with Destruction of Part of the Base of the Skull and the Atlas, 140.—K. BÜRKNER, Traumatic and Inflammatory Affections of the Middle Ear, 144.—LOUIS BLAU, Cases of Diseases of the Labyrinth, 147.—J. BARATOUX, The Relation of Diseases of the Ear to those of the Uterus, 151. —DR. JACOBY, Reports of Cases of Primary and Secondary Periostitis and Ostitis of the Mastoid Process, 152.—P. MCBRIDE, Contributions to the Pathology of the Internal Ear, 157. KIRK DUNCANSON, Case of Mastoid

Disease, 160.—THOMAS BARR, Caries of the Temporal Bone, 161.—M. BONNAFONT, On certain Pathological States of the Tympanum which induce Nervous Phenomena, attributed, by Flourens and Goltz, exclusively to the Semicircular Canals, 161.—VICTOR LANGE, The Use of the Nasal Douche of Weber, 162.—MR. HULKE, Five Cases of Fracture of the Base of the Skull, 163.—JAMES RUSSELL, Case of Vertigo from Impacted Cærumen, 164.—MR. DALBY, Astringent Lotions in Acute Purulent Inflammation of the Middle Ear, 164.

BIBLIOGRAPHICAL INDEX: Books, 165; Journals, 165.

Number III.

ORIGINAL COMMUNICATIONS.

PAGE

ALEXANDER GRAHAM BELL. Experiments relating to Binaural Audition.... 169

CLARENCE J. BLAKE, M.D. The Membrana Tympani Telephone........... 180

H. N. SPENCER, M.D. The Dry Treatment in Suppuration of the Middle Ear... 184

FRANK ALLPORT, M.D. A Case of Probable Abscess of the Brain, following after, and perhaps dependent upon, an Acute Inflammation of the Middle Ear... 189

SAMUEL SEXTON, M.D. Tinnitus Aurium................................ 193

ALFRED NORTH, M.D. Two Cases of Poisoning by the Oil of Chenopodium.. 197

CLINICAL OBSERVATIONS.

CLARENCE J. BLAKE, M.D. Manometric Cicatrix of the Membrana Tympani. 201

ALBERT H. BUCK, M.D. Unnatural Patency of the Eustachian Tube....... 203

BOOK NOTICE.

Die Gesetze der Physiologie und Psychologie über Entstehung der Bewegungen und der Articulations-Unterricht der Taubstummen. Von Dr. W. Gude. Leipzig, 1880... 206

REVIEWS.

HENRY CARMICHAEL, Presentation of Sonorous Vibrations by means of a Revolving Lantern, 209.—M. BERTHOLET, Stabilité Chimique de la Matière en Vibration Sonore, 210.—LORD RAYLEIGH, The Acoustical Shadow of a Circular Disk, 212.—THE SAME, A New Form of Siren, 213.—KIESSELBACH, A Contribution to the Normal and Pathological Anatomy of the Temporal Bone, with especial regard to the Temporal Bone of Children, 214.—LUCAE, The Ability to Hear the Deeper Musical Tones observed in Persons Partially Deaf, and the Physiological and Diagnostic Importance of this Phenomenon, 219.—KÜPPER, Pulsation in the Membrana Tympani, 223.—HORATIO R. BIGELOW, Anatomy and Physiology of the Chorda Tympani Nerve, 224.—BRETT, A Case of Rupture of the Membrana Tympani, 225.—HARTMANN, Sclerosis of the Mastoid Process, 225.—THOMAS BARR, Abscess of the Brain from Caries of the Temporal Bone, 226.—DALBY, Diseases of the Mastoid Bone, 227.—RUDD LEESON, Chronic Cough Dependent on Inspissated Cærumen, 228.—THEOBALD, Foreign Bodies in the External Auditory Canal, 228.—BÜRCKNER, Report of the Policlinic for Aural Diseases in Göttingen, 229.—HUGO HESSLER, Report of the Policlinic for Aural Diseases at Halle, a. S., 229.—BURCKHARDT-MERIAN, Report of a Policlinical and Private Practice in Basel, 231.—SUÑE Y MOLEST, Polipo Celulo-Globular del Disco Timpanico, 232.—GOTTSTEIN, Exfoliation of almost the entire Temporal Bone, the Result of Necrosis; Recovery, 232.—ZUCKERKANDL, An Unusual Development of

Osteophytes in the Temporal Bone, 234.—McBride and Bruce, The Pathology of a Case of Fatal Ear Disease, 234.—M. Boucheron, Sur un mode de Traitement de Certaines Surdités et Surde-mutités infantiles, 238.—McCall Anderson, Left Facial Paralysis; Tumor near Parotid Gland, probably Syphilitic; Improvement under Iodide of Potassium and Faradization, 238.—Horatio R. Bigelow, Anatomy and Physiology of the Chorda Tympani Nerve, 239.—James Allen, Report of a Fatal Case of Suppurative Otitis, 239.—Frederick S. Eve, Case of Fracture of Temporal Bone, 240.—Harry Lupton, Case of Fracture through the Base of the Skull, 241.—Gardner-Brown, Case of Ivory Exostosis in the External Auditory Canal, 242.

Bibliographical Index: Books, 243; Journals, 243.—Notes, 246.

Number IV.

ORIGINAL COMMUNICATIONS.

PAGE

Charles R. Cross and Wm. T. Miller. On the present condition of Musical Pitch in Boston and Vicinity 249

Albert H. Buck, M.D. Fractures of the Temporal Bone 264

Charles H. Burnett, M.D. Ulceration in the External Auditory Canal, with Perforation of the Membrana Tympani, produced by diseased Teeth. 285

Samuel Sexton, M.D. A note on the Aural Phenomena produced by Chenopodium Poisoning 292

Clarence J. Blake, M.D. On the Occurrence of Exostoses within the External Auditory Canal in Prehistoric Man 295

Samuel Sexton, M.D. New Aural Instruments—Polypus Snare—Foreign-body Forceps 298

CLINICAL OBSERVATIONS.

Samuel Sexton, M.D. Three Cases of Sudden Deafness from Syphilis..... 301

BOOK NOTICES.

Lehrbuch für Ohrenheilkunde. Victor Urbantschitsch 377

Quelques Considérations sur l'otorrhée sans lésions osseuses et sur son traitement. Thèse pour le doctorat en médecine, 28 Avril, 1880, Faculté de Médecine de Paris. Par Albert Brisson 331

The Index Catalogue of the Library of the Surgeon-General's Office, U. S. A. Vol. I. (A. to Berlinski). Government Printing Office, Washington, 1880 332

MEETINGS OF SOCIETIES.

Thirteenth Annual Meeting of the American Otological Society, 1880 309

Forty-eighth Annual Meeting of the British Medical Association; Proceedings of the Subsection of Otology 313

REVIEWS.

R. Koenig, Researches upon the Vibration of a Standard Tuning-Fork, 334.—A. J. Ellis, Notes of Observations on Musical Beats, 340.—A. E Bridger, Reflex Cough from Inspissated Cerumen, 340.—Spamer, Experimental and Critical Contribution to the Physiology of the Semicircular Canals, 341.—W. Kohlrausch, On Tones Produced by a limited Number of Impulses, 343.—Fletcher, New Audiphone, 344.—Charles A. Todd, Dry Treatment of Otitis Media Purulenta, 344.

Bibliographical Index: Books, 345; Journals, 345; Notes, 347.

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ORIGINAL COMMUNICATIONS.

ON THE NUMBER OF VIBRATIONS NECESSARY FOR THE RECOGNITION OF PITCH.

By PROF. A. E. DOLBEAR,

TUFTS COLLEGE.

The smallest number of vibrations necessary to produce the sensation of a continuous sound have been variously estimated by different investigators. Savart set it at seven or eight per second, while Helmholtz made it as high as 30 per second. These estimations must be considered as purely individual ones, depending upon the capacity to perceive sounds, which is markedly different in different persons. Granting the sympathetic vibration theory of the rods of Corti, it is plain that greater sensitiveness of these rods would insure that they should retain the energy of the impulses a longer time, just as a sympathetic tuning-fork not only responds quickly, but continues to vibrate for a time after the originating impulses have ceased. A very sensitive ear might be expected to perceive a continuous sound with a smaller number of vibrations per second than a less sensitive one. The pitch of a sound may be defined as the rate of vibration per second. The absolute number per second being of no moment, a C. tuning-fork making 512

vibrations in a second would give the same pitch if it vibrated for only half a second or a less fraction; but, what is the least number of vibrations that will enable an ear to detect pitch?

Theoretically, there can be no rate, and consequently no pitch, to a single vibration. It is essential that there should be two or more to establish a rate, and, to be heard as continuous, must follow each other with an interval not greater than the perception limit, which varies in different individuals, as mentioned above. For the average individual it will probably be not greater than $\frac{1}{30}$ of a second, otherwise they would be heard as distinct pulses without pitch.

With the ordinary apparatus for the study of sound, such as forks, pipes, or syren, it is impossible to determine this low limit experimentally, as they cannot be made to sound for so brief an interval as to make but a few vibrations; but, with the following device, I found no trouble in recognizing pitch with only three or four vibrations. Let the finger-nail be drawn across a piece of ribbed paper or cloth such as many books are now bound with, and a whistling sound will be heard, and the pitch may be readily determined. Of course it will vary with the velocity of the hand. The number of ribs passed over in a given interval of time must give the number of vibrations; but, to perceive the pitch, it is necessary to touch but three or four of these, which was determined by using a lead-pencil and a light-colored piece of ribbed paper. The pencil recorded the number of ribs touched. The rate was such as to be not less than 1,000 per second, and consequently the whole interval was but $\frac{1}{250}$ or $\frac{1}{300}$ of a second. I was able to touch only two at a trial, else I have no doubt they would have been sufficient to enable me to perceive the pitch; but, as the difficulty seems to be purely a mechanical one, there is no good reason for believing that more than two vibrations are requisite for the recognition of pitch.

A RESONANT TUNING-FORK.[1]

(Read before the American Association for the Advancement of Science, Saratoga, 1879.)

For the purpose of rendering audible the sounds produced by tuning-forks, they are generally mounted upon resonant boxes containing a column of air, whose vibrating period is the same as that of the fork.

I have devised a modification in which the box is dispensed with, the resonant chamber being formed by the prongs themselves. To make the fork, a thick bell-metal tube has one end closed, a slit is sawed through the centre of the tube nearly to the closed end. This divides the tube, and gives two vibrating prongs. To bring the prongs in unison with the column of air between them, the tube is put in a lathe and turned thinner until unison is attained, whereupon the sound is powerfully reinforced.—Thomas Alva Edison.

The form of tuning-fork devised by Mr. Edison, and here described, is especially useful to the aural surgeon in conducting comparative tests of the duration of perception of musical tones—not only the tests in which comparison is made with a more or less definitely determined normal standard of duration or perception, but tests especially in which a comparison is made between the two ears of the individual tested. In making a test of this kind we have a more or less definite measure, aside from a test of the real perceptive power, of the sound-transmitting capacity of the middle ear. With the tuning-fork in vibration we have a tone of determined value, gradually diminishing in intensity, in the amplitude of its vibrations, in the

[1] This communication appears also in the American Journal of Science and Arts for October, 1879, and in the Scientific American.

power of the resultant sound-waves to overcome an obstacle presented by the sound-transmitting structures of the middle ear. If the sound-waves resulting from the vibration of the tuning-fork are conveyed alternately to one and the other ear of an individual tested, the tone gradually dying away, a ready means is afforded for the comparative test in question. The advantages offered by the Edison tuning-fork for this purpose are: firstly, its staying qualities, the duration and fulness of its tone; and secondly, its ready adaptability to the end in question.

If, in place of the solid plug which forms its base, a perforated plug with a metal tube is inserted, the triple diagnostic tube can be attached to the tuning-fork by slipping one end of the rubber tube over the metal tube, the remaining ends armed with the usual ear-pieces being inserted in the ears of the patient. The tuning-fork having been set in vibration, these latter tubes may be alternately closed and opened, as in the usual tests, and the comparative duration of perception of the two ears accordingly determined.

Clarence J. Blake.

A FORM OF MIDDLE-EAR SYRINGE.

By CLARENCE J. BLAKE, M.D.,

BOSTON.

The recent publications of Hartmann[1] and Schalle[2] are both my excuse and my inducement for presenting the form of middle-ear syringe which I have now had in use more than five years, and to which allusion is made in a paper on Perforation of Shrapnell's Membrane.[3] The great importance of taking into consideration, in each and every case of purulent inflammation of the middle ear, the condition of that portion of the tympanic cavity which is out of sight—and therefore but too likely to be out of mind as well—is abundantly evidenced by reviewing any considerable number of cases of chronic purulent middle-ear disease, when it will be found that the cases in which the inflammatory process does not extend above the line of the anterior and posterior pockets of the membrana tympani are the exception, and not the rule. The contour of the upper portion of the tympanic cavity, the narrowing of its lower border by the projection inward of the pockets of the membrana tympani and of the inner tympanic wall, the filling up of the remaining space by the ossicula and their appendages, including reduplications of the mucous membrane, more or less constant in all cases, and often existing to so great an extent as to stretch half across the tympanic cavity—these conditions favor the retention of purulent secretion, serving thereby to perpetuate an inflammatory process, one of the first steps for the relief of which must be a liberation of the retained secretions and a thorough cleansing

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[1] Deutsch. med. Wochenschr., No. 44, 1879.

[2] Zeitschrift für Ohrenheilk., Bd. viii., S. 28.

[3] Perforation of Shrapnell's Membrane in Purulent Inflammation of the Middle Ear. Clarence J. Blake, Trans. Am. Otological Soc., 1874.

of the diseased surface. These conditions interfere also with the accomplishment of the desired end by the ordinary means, that is, by the use of the common syringe, or by cleansing with the cotton-tipped probe.

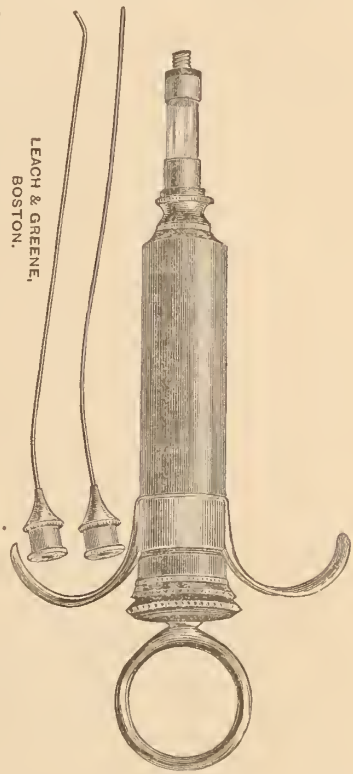
In using the common syringe, while a large volume of fluid is thrown forcibly into the middle ear, supposing the conditions for a thorough cleansing of the tympanic cavity by this means to be the most favorable, that is to say, supposing a large perforation of the membrana tympani to exist, the fluid injected cleanses principally the lower portion of the tympanic cavity only, since it is almost impossible to direct a stream of fluid from the entrance of the external auditory canal in such a manner as shall send any considerable portion of it above the line already mentioned, and because, moreover, the filling of the lower portion of the tympanic cavity with the injected fluid first imprisons the contained air in the upper portion of the cavity, and so prevents the rise of the fluid above a certain level. With a cavity of so complicated a contour moreover there must be portions which the fluid injected by means of the ordinary syringe will not reach.

The objections to the cleansing in these cases by means of the cotton-tipped probe are these: the cleansing by this process is accompanied by a greater degree of irritation, and there is a tendency to pack the contained secretion into the depressions in the walls of the cavity, rather than to remove it.

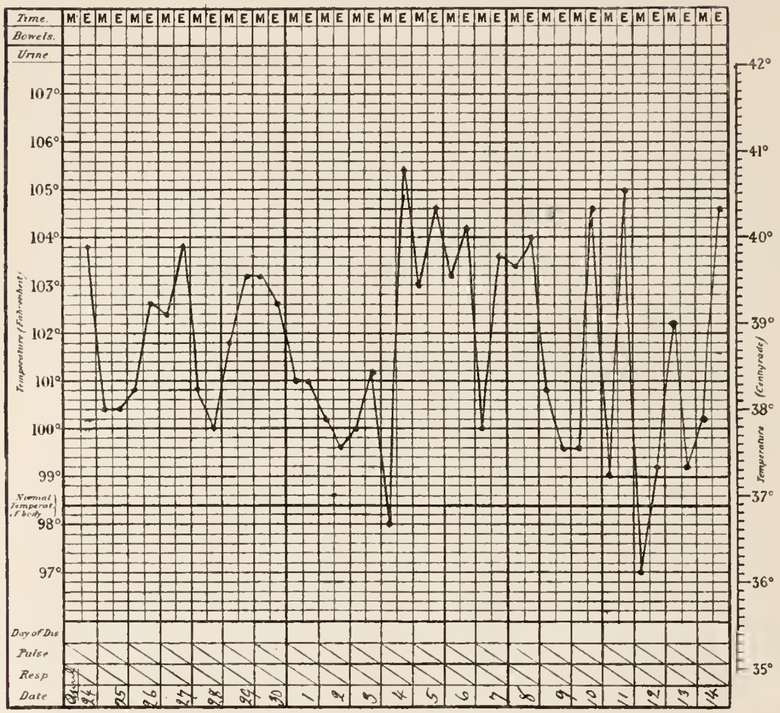
By means of a middle-ear syringe, however, of whatever form, a stream of fluid may be directly applied, and the upper portion of the tympanic cavity thoroughly cleansed. The precautions which must be taken in the use of such an instrument readily suggest themselves; and that, when these are observed, the instrument may be safely and efficiently employed is evidenced, in my own experience, by the fact that the only untoward symptoms which I have seen have been due to forcible contact of the point of the injecting tube with the inflamed tissues, as the result of my own want of care, or the intractability of the patient—and these instances have been very rare. The value of this means of cleansing and of making applications to the middle ear is well shown in cases of chronic purulent otitis media, with destruction of the membrana

tympani, in which the ordinary treatment has resulted in a restoration of the visible portion of the mucous membrane to its normal condition, or nearly so, the purulent discharge coming evidently alone from the upper portion of the tympanic cavity.

The instrument represented in the accompanying woodcut consists of a small hard rubber dental syringe, the nozzle of which has been removed, and a short nozzle, having a screw-thread cut upon it, substituted therefor; to this may be screwed directly the slender nozzles, made of silver tubing, also represented in the cut. These tubes are of various sizes, from 0.5 mm. to 1.0 mm. in diameter, and may be bent at any desired angle. The syringe has a sufficient capacity to ensure a thorough washing out of the cavity with so small a tube, usually with one or two full injections, it being advisable to pause occasionally during the injection, after the introduction of the syringe, on account of the dizziness which is sometimes induced by a continuous stream. After cleansing the cavity, for the purpose of introducing the stronger medicated solutions, the tube may be removed, and the small glass tube, also armed with a male screw at its outer end, may be screwed upon the syringe; and, the piston being first partially withdrawn, the glass tube may be filled with the medicated solution by further withdrawal of the piston; the silver tube is then screwed upon the glass tube, the syringe again introduced, and the injection made. As the last drops of the solution are by this means ejected in a fine spray, the general distribution of the medicated fluid is, if desirable, ensured. Over the body of the rubber syringe slips a metal ring having two wings, which serve for rests for the index and



middle fingers of the hand working the syringe. The ring being made to fit the body of the syringe tightly, the instrument, with the glass tube, may be also used for withdrawing fluid. The object of using a removable ring is to permit the substitution of a fresh syringe, the least expensive part of the instrument, whenever it shall become foul.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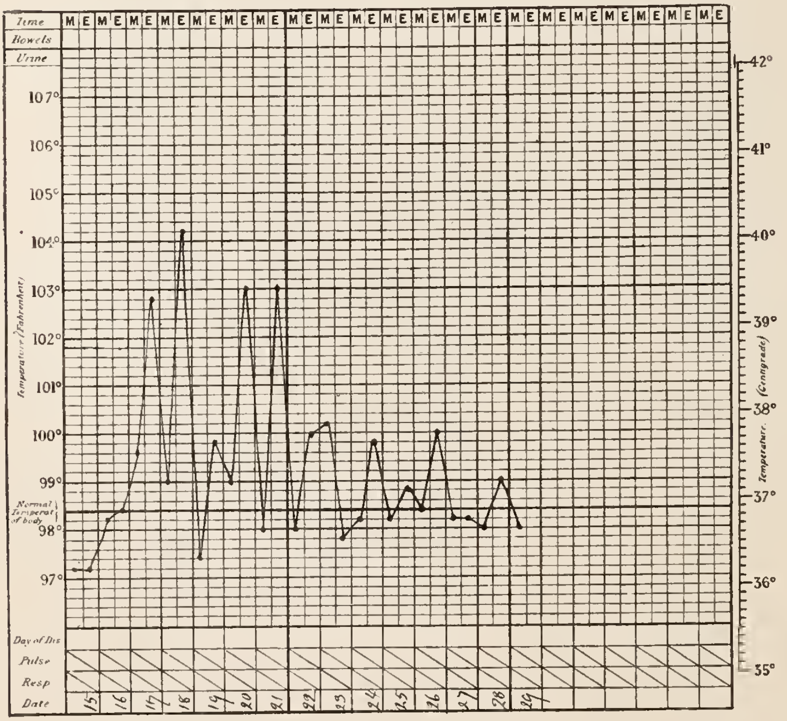
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A CASE OF FOREIGN BODY IN THE EAR PRODUCING SEVERE CEREBRAL SYMPTOMS; REMOVAL AND RECOVERY.

By URBAN PRITCHARD, M.D., F.R.C.S.,

Aural Surgeon to King's College Hospital; Senior Surgeon to the Royal Ear Hospital, London, Eng.

(For references to temperature, see accompanying chart.)

In April last a boy was admitted into King's College Hospital, under Mr. Henry Smith, with a foreign body in the left ear, which was producing severe inflammation and cerebral symptoms. Mr. Smith transferred him to my care, and I received the following history:

J. J., a country lad, aged 14½ years; five years ago, while playing at conjuring, he accidentally pushed the seed of a locust-bean into the left ear. This produced no irritation or particular annoyance at the time, nor until about six weeks before admission.

Three years ago he had a sunstroke, which laid him up for six weeks, but from which he apparently quite recovered.

Six weeks ago the left ear became very painful and a discharge of purulent matter appeared. He was seen by Dr. Tucker, of Farmingham, who succeeded in removing a portion of the seed; but the pain and inflammatory symptoms increased, and the discharge became very profuse. Soon after the patient became subject to attacks of intense headache, chiefly referred to the occipital region. Dr. Tucker at length succeeded in persuading his parents to send him up to King's College Hospital, and he was admitted on April 21, 1879.

Condition on admission: A well-grown lad; not very intelligent, but his mother states that he was always somewhat dull and heavy; complaining of severe headache, chiefly in the occipital region, profuse discharge from left meatus, tenderness with occasional pain in parts around the ear. Pharyngeal mucous

membrane congested and slight ulceration on each tonsil. Hearing only with right ear, and not quite normally with that.

On examining left meatus by speculum it was found completely blocked up by a circular fringe of polypoid growths; on carefully introducing a probe, some hard substance was distinctly felt close behind the small growths. The house surgeon (Mr. Hugh Smith) succeeded by gentle means in removing a small portion of the dark skin of a seed.

April 28.—Since admission he has had several attacks of severe occipital pain, which has been relieved once or twice by epistaxis; there has been no vomiting, the temperature has fluctuated considerably, varying from 100.4° F. to 104°. The meatus has been syringed out with a solution of lead and morphia night and morning. Deeming it unwise to wait any longer, I proceeded to operate for the removal of the seed.

Operation.—The patient being under the influence of ether, and a good light (daylight) directed into the meatus, I proceeded to remove all the polypoid growths by means of forceps. These having been removed, the blood cleared, and the bleeding stopped by syringing out the meatus with a dilute solution of perchloride of iron, the black mass of the seed was distinctly visible by means of the speculum; the presenting part was rough and felt like cartilage, so much so that at one time I feared I was touching necrosed bone. I next endeavored by forcible and prolonged syringing to remove the seed, but entirely failed to remove the chief mass. However, the two cotyledons were syringed out, and some small pieces of the skin of the seed.

I then tried to dislodge it by the gentle use of probes, forceps, etc., so as, if possible, to allow space for the water from the syringe to pass, the return current of which might bring out the foreign body. All these means failing, I endeavored to insinuate with great care a Lister's hook between the wall of the meatus and the seed, and after several failures at length succeeded; then rotating the instrument a little and withdrawing it, I succeeded in extracting the remaining portion of the seed. This had swollen to the size of a small hazel-nut, and in substance closely resembled cartilage.

May 1.—The temperature rose after the operation, but has now fallen to 101°, pulse 80. There is only a very slight discharge from the meatus now, but he complains of great pain in the head.

May 5.—The temperature, which had fallen yesterday morning to 98°, rose last evening to 105.4°, pulse 120, and the headache, which had been diminishing in severity the last day or two, has again come on intensely. There is tenderness on percussion about one inch and a half behind and a little above the level of the left mastoid process. Bowels constipated; enema ordered. Discharge from ear has ceased; no tenderness on pressure about meatus.

May 6.—Bowels opened three times; great pain in occipital region; a blister ordered behind left ear.

May 8.—Yesterday pain better after blister, and temperature fell to 100° in the morning, but rose again in the evening. An incision made through scalp right down to the bone, an inch in length, about one inch and a half behind left auricle, which was followed by free hemorrhage.

May 12.—There was some relief to the pain after the incision, but the temperature has been fluctuating. Wound plugged with carbolized lint.

May 15.—Temperature fallen to 97°. Not so much headache, but patient losing flesh.

Meatus carefully examined. No discharge, no sign of any polypi; surface quite normal, except a little abrasion at the upper and posterior portion.

Membrana tympani somewhat thickened, handle of malleus only just discernible. Hearing distance increased to 1½ per cent. as measured by watch. Tuning-fork on bridge of nose heard distinctly and normally on left side.

May 19.—Temperature has been fluctuating. Hearing distance increased to 4 per cent.

May 26.—Much improved since 21st; has had no headache for about ten days. Hearing distance, 4 per cent., increased to 7 per cent. after inflation by Politzer's bag.

June 5.—Has been improving and gaining flesh since last note. Hearing distance: right ear, 30 per cent; left ear, 16 per cent.

June 9.—Hearing distance: left ear, 20 per cent.

June 11.—Discharged, looking stout and well.

Comments.—There are many points of interest in this case, but I shall only remark on two, which appear to me to be especially interesting:

Firstly, the pathological connection between the primary lesion in the meatus and the secondary lesion within the cranium.

Secondly, the question of the proper mode of treatment in these cases.

Pathology.—In tracing the ear mischief to the brain, the following considerations will act as guides:

(*a*). The internal ear could not have been the seat of any lesion, for it performed its functions properly, as shown by the tuning-fork (when applied to the bridge of the nose) being heard more distinctly on the affected (left) side, which of course is the case when the external or middle ear is affected, and not the internal. Further, there were no symptoms of labyrinthine vertigo.

(*b*). There were no symptoms of inflammation in the mastoid cells, which is so commonly the link between disease of the middle ear and of the meninges. The only indication of middle-ear affection was some slight catarrhal block of the Eustachian tube. And further, there was no hole, or sign of old hole, in the membrana tympani. From these considerations it is quite clear that the connection was not through the internal or middle ears.

Therefore the extension must have been directly through the bony wall of the meatus, probably the upper portion which is in close proximity to the brain.

In post-mortem examinations, in similar cases, I have on several occasions traced injected veins from the diseased part through the bone to the inflamed meninges, and I have no doubt that the extension is through the veins, frequently against the usual current of the blood.

In this case I presume that, the source of irritation and infection in the meatus having been removed, the cerebral disease was arrested just short of suppuration, and thus the patient was enabled slowly to recover.

Treatment.—In determining the proper mode of treatment in such cases, the following points must be noted.

(*a*). That a foreign body may remain in the meatus a very long time without producing any serious lesion, as shown by this and many other cases on record.

(*b*). That, after unsucessful attempts at removal by the introduction of instruments, the symptoms may be much aggravated, for the substance will then act really as a foreign body in the irritated meatus.

(*c*). That in such a condition the inflammation is very liable to extend to the brain.

(*d*). That there is great difficulty in removing seeds which have swollen: this seed must have swollen to more than twice its diameter.

These considerations lead us to make a few practical suggestions as to treatment:

1. That a foreign body which is not irritating the meatus may be left to a convenient season for removal; but that if the body be a seed, it should not be left long enough to swell.

2. If syringing fails, as is often the case with a swollen seed, that no attempt at removal be made by means of instruments introduced, until all the conveniences and appliances are at hand to insure success.

I would further add that the greatest possible care and gentleness should be employed, so as not to lacerate the membrana tympani, nor even the skin of the meatus, if possible.

Lastly, I am sure I shall not be considered presumptuous by suggesting that all cases not relieved by syringing, and likely to prove difficult, should be placed in experienced hands without resorting to any haphazard attempts at removal.

UNINTERRUPTED WEARING OF COTTON PELLETS AS ARTIFICIAL DRUM-HEADS.

By CHARLES HENRY BURNETT, M.D.,

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There has never been but one useful kind of artificial drum-head, and that is the cotton pellet of Yearsley. Other forms have been devised, and apparently have been of service, though only to a limited degree. Aurists of the present day, if they employ any form of artificial drum-membrane, find most satisfaction in the cotton pellet. Very little, if any, modification of the rules governing its use, as given by Yearsley [1] has been suggested. In fact, Yearsley's rules need nothing but some additions. In the work and place just quoted he has condensed his experience of a number of years into seven rules or reasons, which I venture to give in extenso.

"I claim for moistened cotton-wool a superiority over all other substances, as the best material to be used, for the following reasons: 1. It is more easily applied. 2. It is simple, safe, and cleanly. 3. It retains its proper position longer. 4. It causes no irritation, but, on the contrary, a feeling of comfort. 5. It produces no noises in the ear in the acts of eating or talking. 6. It cures the discharge of the ear which generally attends loss of the membrana tympani. 7. It produces the highest degree of hearing of which a patient with perforated membrana tympani is susceptible."

He next says: "Any substance will produce the desired effect, if applied so as to support the remaining portion of the membrane or the ossicula; but cotton-wool is the best, for the reasons already assigned."

To these seven reasons there should be added that the application, removal and renewal of the cotton pellet should be done only

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[1] Deafness, etc. London, 1863, p. 262.

by a skilled physician properly supplied with a forehead mirror and delicate instruments, with the use of which he is thoroughly familiar, and, after the cotton-pellet has been successfully adjusted, it should be worn as long as possible by the patient, without removal or manipulation on his part, of any kind. Another very important consideration in the successful use of cotton pellets is, that the ear must have ceased to discharge before they are introduced into it.

It must be borne in mind that Yearsley had not absorbent cotton at his command, nor had he a well-arranged forehead mirror, and yet he obtained excellent results, as is very well known by all the world. Of course, he was misrepresented by his contemporaries; quacks seized his idea and most notoriously failed, thus, of course, throwing discredit on the valuable remedy he had introduced to the profession; and some members of the latter body curtailed the application of Yearsley's artificial membrane by devising vastly inferior ones, which, with a great spirit of rivalry, they vaunted and succeeded in obtaining a place for. It was thus the inferior artificial aid known as Toynbee's, came into notice. Yearsley's defeating suggestion was that his instrument should be applied by the patient, which, of course, implied that any physician could apply it.

This suggestion was not incorporated in his "rules," but it opened wide the way for mistakes in application, disadvantageons forms of the artificial membrane, and, of course, finally, great discouragement to its use, and, perhaps from some quarters, condemnation of all forms of artificial membrana tympani.

So far as my own experience is concerned, nothing but the cotton-pellet drum-head has ever produced any good results, unless I except the paper-disc drum-head of C. J. Blake; and this, having so many advantages kindred to Yearsley's cotton pellet, has proven of value in my hands, and I believe it has an useful future. But my widest experience has been with the cotton pellet, and of this I wish to speak.

It will be observed that when, in 1863, Yearsley formulated his experience with the cotton pellet, into his seven "reasons," he omitted saying anything about the patient's adjusting their own

pellets, nor did he allude to the period a pellet, once well placed, might be worn. By implication he permits patients to introduce an artificial drum-head into their ears, and this also includes frequent adjustment of the same. Originally, from 1848 to 1853, he distinctly enjoins daily removal and renewal of the cotton pellet; but this has not seemed necessary nor desirable in all instances in my experience, and in proof of this I adduce the following cases:

CASE I.—Josephine H., an English girl, aged 16 years; is going to school, but is impeded in advancement in her studies by hardness of hearing in her right ear. Her mother states (December, 1875), that she has been liable to attacks of earache, discharge of matter, and dulness of hearing on that side for some years.

An examination with ear-funnel and mirror reveals a chronic muco-purulent discharge from the tympanum, with a perforation in the lower and hinder quadrant of the membrana tympani, about two mm. in diameter. Hearing reduced to a few paces. Moderate syringing at home, and the use of drops of a solution of sulphate of zinc (3 gr. to f. ℥ i. water) checked the discharge in the course of a few weeks, but the hearing was not much improved. The mucous lining of the drum-cavity was still red, and looked raw; and in order to protect it from the winter weather then prevailing, I laid over the perforation a small pellet of cotton, with a diameter slightly greater than that of the perforation.

This improved the hearing greatly, and the pellet was allowed to remain over the perforation for some days. In the course of a week the cotton pellet was still in proper position, the hearing remained very good, and the ear felt more comfortable, *i. e.*, not tender on exposure to the open air. In the course of a few weeks, with a coryza, a little discharge came from the ear, washing away the artificial drum-head. But the inflammation was soon allayed as before, the discharge checked, and a cotton pellet applied again. I did not see the patient for some weeks, but when I did inspect her ear again the pellet was in proper position, the hearing was very good, and the membrana tympani around the cotton pellet looked dry and normal. Upon removing the cotton pellet the perforation was found to have grown smaller; another pellet was put over it, and the patient was not seen again for some weeks, when it was observed that the cotton pellet was in good position and the ear in every way doing well. Some months later the patient called again for inspection, when, upon removing the small pellet of cotton, which had been worn all the time of her absence from me, the perforation was found to have entirely healed, without a flaccid cicatrix, but with a properly tense renewal of the membrane. And this good condition of the ear persisted for a year longer, after which time the patient has been lost sight of.

This case shows the very important and valuable functions of the permanent cotton pellet: 1. That it improved the hearing; and, 2. That while aiding the hearing it stimulated the closing of the perforation in the drum-head. And how simple the treatment!

CASE II.—Peter S., aged 58 years, a manufacturer of chemicals. Is almost totally deaf in both ears from a run-out purulent process of great duration. In the right ear, where the membrane is almost entirely destroyed, a little portion in the region of the malleus alone remaining, with the ordinary peripheral rim of the annulus cartilagineus, a large cotton ball, slightly moistened with glycerine, was placed. The other ear could not be improved by the cotton pellet. With the right ear thus treated his hearing rose to several feet for words of ordinary tone, and the pellet of cotton, thus fortunately placed, he wore from August 30th to October 13th following, and the patient was able, during this period, to hear all that was addressed to him in the laboratory. In this case there is offered a good example of the possibility and convenience of a prolonged wearing of the artificial drum-head.

CASE III.—December 3, 1878. Mr. J. M., aged 35, states that within a year he has grown deaf, after an attack of acute otitis media, first on the right side, and then on the left. He attributes his aural disease to the use of the nasal douche, which his physician allowed him to use with *great pressure*, for the cure of naso-pharyngeal catarrh. The patient is phthisical.

On examination I found, on the right side, a large perforation in the anterior inferior quadrant of the membrana tympani, the latter being retracted, and the hearing reduced to one foot for the voice at ordinary tone.

On the left side two perforations were found in the membrana tympani, one in the anterior, the other in the posterior inferior quadrant. The remnant of the membrane was silvery and dry, and not so retracted as the other; the mucous membrane of the tympanic cavity was very red. Hearing three feet for the ordinary voice. The mucous membrane of the pharynx was purplish red, and a copious, white, frothy mucus flowed from behind the velum palati. There was no discharge from either ear. Eustachian tubes easily pervious to inflation by Valsalva's method.

A pellet of absorbent cotton was placed dry over the perforation in the right membrana tympani. The ear was quite sensitive to the pressure of the cotton at first, but in a few moments the pain passed off. The hearing was not improved immediately by the artificial membrane, but, after wearing it as I had placed it, for two days, the hearing gradually became better, until it was found to be nearly normal. This continued for six days, when, after gargling one morning, the patient said his hearing in the right ear had become dulled. I was therefore induced to remove the pellet, with a view to reädjustment, and the hearing was immediately thereupon reduced markedly, and a

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fresh cotton pellet did not immediately improve it, thus showing what I have observed in other cases, that it is best not to remove a cotton pellet when a slight diminution of hearing ensues, so long as the pellet seems to be in the position in which it was placed by the surgeon, and no discharges have soaked it.

The second pellet was removed in twenty-four hours, as it did not seem to improve the hearing, and a new and larger one was inserted. In this case each pellet had been placed so as to leave a small crescentic opening at the anterior part of the perforation.

The third pellet was packed farther into the tympanic cavity, and back toward the stapes, *i. e.*, upward and backward. This made the hearing better, but not as good as the first pellet, which I regret I moved at all, as, during all this unnecessary manipulation, no discharge was coming from the drum-cavity. In fact, the first pellet had become slightly adherent to the membrana tympani from the drying of a little of the natural secretion of mucus from the tympanum.

The last pellet of cotton was allowed to remain over the perforation until Dec. 28, 1878, a little over two weeks, when it was removed in order to put in a clean one. The latter improved the hearing as much as its predecessor. At this date a cotton pellet was placed over each perforation in the left membrana tympani, and the patient then made a journey in the depth of winter, far out in the West, and I did not inspect the ears until Jan. 21, 1879, nearly one month later. The hearing was slightly improved on the left side, but not so much as on the right side, by the artificial aid. But both ears had been protected during the cold and exposure of a winter journey.

On the 21st of January, 1879, twenty-four days later, after the patient's return from the western tour, all the cotton pellets were removed, as they had become unclean from mucous absorption and from cerumen, which the ears secreted to a great extent, and it was observed that the two perforations in the left membrane had united to form one large heart-shaped one. Fresh pellets were adjusted as before, with the same results, viz.: considerable improvement in the right, with less in the left ear.

On March 15, 1879, fifty-three days later, the same process of renewal was gone through with, with similar results, the mucous membrane of the drum-cavities in the meantime having taken on a healthier look and action.

On April 11, 1879, twenty-eight days later, the cotton pellets were taken out of, and not reinserted into the left ear, as the hearing had become better, independent of their pressure, but could not be augmented by their insertion.

A fresh pellet in the right ear, covering about a third of the drum-membrane in the region of the perforation, improved the hearing on this side as theretofore.

On the 27th of May, 1879, forty-seven days later, the cotton pellet was

taken out of the right ear, and the hearing having reached a permanent improvement, with the cotton pellet out of the ear, and the approach of warm weather rendering such protective influence unnecessary, the ears, now permanently better, were left to themselves.

On the 17th of November, 1879, the patient informed me that his hearing had remained very good all summer, and that there had been no pain or discharge from the ear since I had seen him. The hearing was found to be nearly normal, though the perforations persisted in each membrana tympani. The mucous membrane of each drum-cavity was congested, and there was some naso-pharyngeal catarrh, but the condition of the ears did not seem to demand any artificial drum-membrane. Here was a case that seemed to show the advantages of long periods of wearing the cotton pellet as a protector to the inflamed drum-cavity and as an aid to hearing during the process of quasi-healing.

CASE IV.—Mr. L. S. J., aged 83, a retired manufacturer, has been liable to attacks of pain and discharge, in the right ear, for a number of years, usually whenever he had a severe cold in his head. The hearing long ago became greatly impaired on this side, and as the hearing has gradually failed on the left side, with the sclerotic affection of old age, he consulted me on June 4, 1879. On the right side the membrana tympani was found largely perforated in its front half; its remnant was dry and pale pink in color; the mucous membrane of the drum-cavity was not very red, though decidedly congested. There was no discharge from the ear, and the wall of the auditory canal was covered with very adherent, hard, dark scales—probably composed of purulent and epithelial débris, stained by nitrate of silver, which had been used by his family physician, on this side, to stop the discharges from time to time.

The left membrana tympani was opaque, gray, indrawn, and lustreless.

H. for ordinary voice on right side = 6 in. H. for ordinary voice on left side = 6 in.

It was proposed to try the effect of an artificial drum-head on the right side, and on the 6th of June a small pellet of cotton, moistened with glycerine and water (1–4), the size of a small pea, was laid firmly over the perforation in the right drum-head.

This instantly improved the hearing to three or four feet for the ordinary vocal tones, and enabled the patient to hear conversation at table, which he had been deprived of for a long time. He was asked not to disturb the cotton pellet, and did not, wearing it faithfully for twenty days, when I saw him again.

It was found that with a little cold his ear felt uncomfortable, and that he could not hear so well; and also on the anterior wall of the auditory canal, on the dark scale of adherent matter, a patch of aspergillus nigricans had sprung up. The entire scale was now easily lifted out, having been softened by the contact of a little glycerine and water. Fearing that spores of the fungus might have gotten into the depths of the canal and in the cotton pellet, the latter was removed and the entire canal and tympanic cavity subjected to instillations of alcohol and water in equal parts, three or four times daily for three or four days. No further signs of aspergillus showing themselves by June 30th, a fresh cotton pellet was placed in the ear as before, and with the immediate improvement in the hearing.

The auditory canal was now entirely clean, with bare pink walls, but a close watch was kept for the reappearance of the inveterate parasite. By July 3d a little patch of delicate down of aspergillus was observed on the floor of the auditory canal near the artificial drum-head; the latter extended over the perforation, and down as far as the floor of the canal. This patch was simply deluged with a drop of absolute alcohol on a tuft of cotton on the cotton-holder. This controlled the growth from spreading; but on the 7th, the patch still being plainly visible, though smaller, it was treated in the same way with absolute alcohol, the cotton pellet all this time being in perfect position over the perforation, and acting as a great aid to hearing. The aspergillus showed no signs of growing over it, and it occurred to me that perhaps the mere presence of a pellet of absorbent cotton, deprived as it is of oily matter, proved an unpropitious soil, and further, acted as a mechanical hinderance to the inward growth of the fungus toward the drum-cavity.

On July 11th the ear was found to be in good condition, the cotton pellet still clean, in the position it was put in, and aiding the hearing very markedly. On July 14th the patient was seen for the last time prior to a long visit at Sharon Springs. The cotton pellet put into the ear on June 30th was still acting its part as aid and protector, and was allowed to stay in the ear. The summer was then passed at the Springs, and the cotton pellet continued to act well, and was still there in November, 1879.

This beneficial effect of prolonged wearing of cotton pellets I have seen in many other cases, but these four, presenting, as they do, good examples of such an use of the artificial membrane in people of different ages, occupations, and social surroundings, seem to be enough for illustration of the point it is desired to enforce.

It may, therefore, be concluded that, when the membrana tympani is perforated, and the discharge from the tympanum has

ceased, a cotton pellet will do more good when properly adjusted by the surgeon and let alone, than if manipulated every day, and that such artificial drum-membranes act both as temporary aids to hearing, and favor by protection, and, perhaps, by gentle stimulation, the healing of the chronically inflamed mucous membrane of the drum-cavity, and the closing of the perforation of the drum-head; though general improvement of the ear and hearing may ensue without the latter result.

FURTHER OBSERVATIONS ON "THROAT-DEAFNESS ASSOCIATED WITH PARESIS OF THE PALATO-TUBAL MUSCLES."

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The following observations are supplementary to the article on paresis of the palate associated with deafness, which appeared in the October number of this journal, and which paper I read in the Otological Section at the meeting of the British Medical Association held at Cork, in August last. On this occasion I had the pleasure of becoming personally acquainted with Dr. Weber-Liel, of Berlin, and both then and since have enjoyed the opportunity of discussing with him the subject-matter brought forward in this paper. In this way I have had the advantage of becoming better acquainted with his views, and found that some of those advanced in my paper, respecting the dependence of certain forms of ear disease on paralysis of the palato-tubal muscles, had been already long anticipated by him, and I am glad to take this opportunity of acknowledging the fact. Especially is his claim undoubted to having shown that "collapse of the Eustachian tube"—a term he originated—may be and often is caused by paralysis of the tensor-palati muscle, and is in fact the starting-point of a disease which must always bear the name of its investigator, viz.: "Weber-Liel's progressive deafness." Undoubtedly, his book on this subject, albeit in places somewhat difficult to grasp by the non-Teutonic mind, is a monument of honest toil directed with consummate skill to the unravelling of one of the most obscure subjects in medicine.

Reverting to the cases which formed the subject of discussion in my paper, it is to be remarked that the major part of them presented themselves for treatment at my clinic during the severe and long-continued climatic experiences of this country which

characterized the winter and spring of the years 1878–9. The symptoms detailed are such as were observed at the time. They all possess one feature in common, which, indeed, is the connecting link of the group, viz.: marked paresis of the palate, unilateral or bilateral, clearly obvious to simple inspection of the region. Having regard to collateral symptoms to be referred to immediately, the presence of this palate paresis led me to predicate a corresponding paresis of the intrinsic muscles of the ear. Thus it will be seen that, though I start with the same element—palate paresis—as my distinguished friend so clearly proves to be the point of departure in his "progressive deafness," yet, beyond this starting-point there is a very striking divergence in the symptoms as well as in the progress, of the two groups of disease.

This difference will be best appreciated by comparing the symptoms of each class side by side, as follows:

SYMPTOMS IN "PROGRESSIVE DEAFNESS."	SYMPTOMS IN AUTHOR'S CASES.
Paralysis of tensor palati muscle.	Paresis of tensor palati; paresis of levator palati; characteristic signs in palate.
Antagonistic contraction of tensor tympani, inducing *depression* of memb. tymp., with characteristic indications in drum-head, ending in *permanent* contraction of tendon of tensor tymp.	Paresis of tensor tympani (probably also of stapedius), permitting membrana tymp. to remain nearly normal in appearance, but deprived of its "accommodating" power.
Deafness, slight at first, gradually increasing, with intervals of abatement.	Deafness, well-marked from first.
Noises, constant.	Noises, exceptional.
Giddiness, occurring at intervals, always present.	Giddiness, none.
Progress, slowly to complete deafness.	Progress, quickly to recovery.

Now, with regard to the argument by which I proposed to explain the symptoms, it was as follows: the tensor palati and tensor tympani receive their nerve-supply from the same source, the otic ganglion; when, therefore, the muscle that can be seen is evidently paralyzed, I inferred the paralysis of the other, which cannot be seen. A similar argument is used in reference to the levator palati and the stapedius. The symptoms observable in the drum-head corresponding with these muscular pareses—viz.: slight amount of depression in the drum-head, together with the absence of giddiness—appeared, and still appear to me to justify the inferential part of the diagnosis.

Obviously then, a group of cases characterized by the *absence* of contraction of the tensor tympani, showing an imperfect ventilation of the tympanic cavity rather than a complete occlusion of the Eustachian tube, and, therefore, with no marked depression of the drum-head; with no giddiness; with tinnitus more often absent than present—cannot be the same disease as one in which these are the salient symptoms. Every aurist is but too well acquainted with the latter combination of symptoms with which Dr. Weber-Liel's name is so emphatically associated, for its successful treatment constitutes the greatest difficulty in a specialty which is without doubt the most difficult of all departments of medical practice. On the other hand, the cases to which I endeavored to draw attention afford, as stated in the paper, no insuperable obstacle to recovery.

How then are these cases—which I propose to define as cases of *paretic deafness*—to be regarded? Are they the initial stage of Dr. Weber-Liel's "progressive deafness"? I think not, as anything like spasmodic contraction of muscle is absent in them throughout. And although analogy shows that a paralyzed muscle is very apt to get a contracted tendon, I do not think Dr. Weber-Liel would admit this rôle of events as applicable to his disease, or in any way consistent with his views respecting it.

My opinion regarding the cases I described is that they occurred as the outcome of an unusually severe and protracted winter, aggravated by circumstances of general depression, and leading up to exhaustion of vaso-motor nerve-force, as described, and that any repetition of a corresponding succession of events will produce another crop of the disease.

I have desired in this supplementary note to do justice to my friend's views, as well as to establish the distinctive character of my cases. The fact that an independent record of *clinical* observations has, so far as they go, exemplified the views previously established by him as the result of laborious anatomical and pathological research, should tend to confirm the correctness of his original conclusions, as well as to direct the attention of otologists to this wide and fruitful field of investigation.

THE COMPARATIVE VALUE OF LEECHES, HEAT, AND INCISIONS, IN THE TREATMENT OF ACUTE CIRCUMSCRIBED INFLAMMATION OF THE EXTERNAL AUDITORY CANAL.

By ALBERT H. BUCK, M.D.,

NEW YORK CITY.

(Read before the Brooklyn Anatomical and Surgical Society, Nov. 24, 1879.)

In acute inflammation of the middle ear, by far the most important indication is to prevent the disease from doing damage to the delicate mechanism contained within that cavity, or from spreading to vital organs in the neighborhood and thus endangering life. In acute circumscribed inflammation of the external auditory canal, on the other hand, the dangers just mentioned are so remote that we may practically leave them out of consideration in deciding to what extent we should interfere with the course of the disease. For instance, the employment of the knife, which, in the case of a middle ear inflammation, might be considered a vital necessity, can here be resorted to or not, according as it is likely to afford relief from pain. In this class of cases, therefore, we are at perfect liberty—in the great majority of instances, at least—to yield to the patient's objections to surgical interference.

Before discussing this subject farther, I should perhaps define more accurately what I mean by "acute circumscribed inflammation of the external auditory canal." I exclude from this category all those inflammations which either originate in the osseous portion of the canal, or develop there by the extension of an otitis media acuta; this latter form of inflammation is in reality a periostitis. I include all those acute inflammations which seem to originate in some part of the cartilaginous portion of the external meatus, and which may take the form of a well-defined conical or hemispherical swelling (furuncle), or may involve this portion of the

canal so completely, that it is impossible for the surgeon to determine in what particular spot the inflammation first began, or where it is displaying its chief activity. Finally, it is hardly necessary to add that those cases in which several small furuncles form one after another in the meatus, without causing the patient more than a sense of discomfort, or, at most, moderate pain, are not taken into consideration in the remarks which follow.

If it be admitted that the chief indication in this form of disease is to relieve the patient from suffering, the question then arises, By what means can this object be attained? I do not propose to try and answer this question fully, but rather to discuss the comparative value of the three plans of treatment most commonly employed under these circumstances, *viz.*, the application of dry or moist heat, the local abstraction of blood by leeches, and incisions through the inflamed tissues.

At first thought it would seem as if there could be but one answer to the question, Which of these three methods of treatment is likely to afford the desired relief most speedily and permanently? Some of the best authorities unhesitatingly give the preference to incisions. Von Troeltsch says: "I am in the habit of incising furuncles at the earliest moment practicable, and do not even wait until it is reasonably certain that pus has formed. The earlier the knife is used, the better."[1] Roosa says: "The proper treatment is to make an incision at as early a period as possible, and then to continuously apply warm water, giving the ear an uninterrupted warm bath, as it were. It makes no difference whether pus or blood be evacuated by the incision. The relief following is generally immediate in either case."[2] Burnett says: "The knife is the quickest and surest way of escape from the pain of these furuncles in the auditory canal."[3] Hinton says: "In furuncles, as the rule, a free incision by a curved bistoury is always desirable."[4] Dalby says: "The whole meatus is so swollen that it is not possible to see the position of the abscess with

[1] Lehrbuch der Ohrenheilkunde. Würzburg. 1868, S. 88.

[2] A Practical Treatise on the Diseases of the Ear. New York, 1873, p. 130.

[3] The Ear; its Anatomy, Physiology, and Diseases. Philadelphia, 1877, p. 261.

[4] The Questions of Aural Surgery. London, 1874, p. 95.

a speculum. This point having been distinctly localized, the sooner an incision is made into it the better, as by this the tension of the parts to which the agonizing pain is due, is relieved."[1] Keene says: "The greatest benefit will, however, be afforded in severe cases by an early incision, which should be made as soon as the situation of the furuncle can be discovered by circumscribed redness, swelling, or tenderness."[2]

With such a weight of authority in favor of the operation, the surgeon would certainly be justified in drawing the conclusion that in acute circumscribed inflammation of the external auditory canal, a free and deep incision through the tissues most intensely inflamed is almost certain to afford speedy relief from pain, and check the further progress of the inflammation. Furthermore, the certainty of relief which characterizes deep incisions in cases of whitlow is also very apt to occur to his mind in this connection, and confirm him in his decision to trust to the knife. Although for several years past I have not been able to satisfy myself fully with regard to the value of incisions in the class of cases we are now considering, I have been conscious of an increasing lack of confidence in their efficacy. As each new case presented itself, I have asked myself the question, Shall I incise the swollen meatus, or not? Influenced by the fear that the inflammation might extend and do some permanent damage, I have nearly always decided the question in the affirmative. Quite recently, however, I have consulted my records of cases for the purpose of ascertaining how far this fear is justified by the facts, and I find that in not a single instance has an acute circumscribed inflammation of the external auditory canal led to really serious results. In only one case were the symptoms sufficiently grave to cause alarm. The history of this case, in brief outlines, is as follows:

Case I.—Female, fifty-three years of age, and of apparently strong constitution, though at the present time quite weak, April 27, 1876. Ten weeks ago she began to suffer from pain in the right ear. It continued with varying severity until about three weaks ago, when a slight discharge appeared.

[1] Lectures on Diseases and Injuries of the Ear. London, 1873, p. 26.

[2] The Causes and Treatment of Deafness. London, 1873.

About two weeks ago, the pain became very severe. Patient had two convulsions at the time, according to the account of her friends. The parts about the ear became very much swollen. The pain and swelling have both continued up to the present time, and there is still a slight discharge. The auricle is red and swollen, especially the fossa conchæ. The orifice of the external meatus is closed by the swollen condition of the parts and by the presence of a small mass of granulations springing from the base of the tragus. The deeper parts are not visible. The watch is heard at a distance of several inches, thus showing clearly that the disease has not involved the middle ear to any extent. On exploration with the probe it is ascertained that the mass of granulation-tissue corresponds to the orifice of quite a large cavity, situated chiefly below the tragus.

As the patient wished to enter some hospital, and as the rooms at the New York Eye and Ear Infirmary were at that time all occupied, I transferred her to the Roosevelt Hospital, where she remained for about two weeks under the care of Dr. Robert F. Weir. She made a complete recovery.

In a second case the inflammation, which at first was confined to the external auditory canal, spread to the neighboring tissues and gave rise to the formation of a large abscess in the parotid region. The patient's illness was materially prolonged by this complication, but she ultimately got entirely well, and the disease left no visible traces of damage. Furthermore, in this very case an incision through the original furuncle in the meatus failed to prevent the complication which so materially added to her sufferings.

In looking over my records of cases, I regret to say that I can find but twenty-eight in which the data are sufficiently full to render them of any value for purposes of study. While this number may seem altogether too small to serve as material from which to draw trustworthy conclusions, it may be stated that there is such a sameness in the course of this particular form of ear disease that the results obtained in any consecutive twenty-eight cases may be safely taken as presenting a fairly true picture of the average results obtained in practice. In seventeen of these cases incisions were employed; in the remaining eleven the treatment was restricted to such milder means as the employment of the douche, the application of dry or moist heat, etc. While I can hardly expect my readers to peruse the dry details of the seventeen cases

in which incisions were used, it will scarcely answer not to give at least an outline sketch of the salient points in each. The histories of these cases are therefore given here in as condensed a form as possible.

Case II.—Female, fifty-four years old, of robust constitution. Itching in the left ear, followed a day or two since by pain. Meatus nearly closed by a rounded swelling, which looks as if ready to break at one point. Free incision; three leeches applied at her home. Speedy and permanent relief.

Case III.—Female, fifty years of age, of fair constitution. February 1, 1873. Pain in left ear, quite severe, for one or two days past. Outer half of meatus almost closed by swelling of its walls. Posterior wall incised. Leeches. Pain soon subsided and did not return.

Case IV.—Male, twenty-seven years of age, laborer. August 2, 1871. Pain of late in the right ear, with slight watery discharge. Examination shows the presence of a furuncle in the right external auditory canal. Free incision; two leeches. August 5. Pain relieved by the above measures, but to-day the ear is again painful. Incision repeated. Patient did not return.

Case V.—Male, twenty-nine years of age, laborer. August 16, 1871. Pain in left ear during past few days. Canal nearly closed by a circumscribed swelling of its lower wall, near the outer orifice. Free incision. Two leeches applied. August 19. Pain gradually passed away after the leeching. Canal to-day is still a little swollen. No further trouble experienced.

Case VI.—Female, nineteen years of age, very much run down in health. October 8, 1873.—Pain developed in the left ear, three days ago. Slight secretion in canal. Circumscribed swelling at base of tragus. Tenderness in front of ear. Free incision. No pus found. Bleeding unusually free. Ordered mist. ferri et cinchonæ. October 11.—Incision relieved the pain permanently. Swelling diminished.

Case VII.—Female, forty-three years of age. December 3, 1873.—Pain in left ear for nearly three weeks. No discharge. Furuncle at entrance to canal. Incision. December 6.—Canal more swollen. Visible swelling on left side of face, below and in front of ear. Granulation-tissue at seat of incision. Pain continues. December 13.—Three days ago an abundant discharge took place from the ear and afforded decided relief from pain. To-day the swelling below the ear is much more pronounced than at last visit. Œdematous swelling extends to quite a distance. Pressure upon the swelling below the ear causes pus to flow from the opening in the meatus. (Transferred to St. Luke's Hospital.)

Case VIII.—Male, forty years old, in good general state of health. July 25, 1878.—Five days ago, after ocean bathing, he began to suffer from pain in right ear. Pain has now become quite severe. External auditory canal reduced in

size, from swelling of its posterior and upper wall. Free incision, followed by warm, moist applications. Relief soon obtained. August 2.—Pain has returned and is very severe. It involves the entire right side of head, canal still red and very much swollen. Incision repeated. Warm moist applications. Relief again obtained from the acute pain, but more or less pain remained for several days. No subsequent relapse. No pus found at any time, though after the second incision a discharge set in and lasted for several days.

Case IX.—Female, twenty-five years of age, in not very good health. July 24, 1879.—A series of boils in the left ear, dating a month back; the last one began to develop four days ago, and the ear has now become so painful that she cannot sleep; large circumscribed swelling of the posterior wall of the canal, near the outer orifice. Free incision; no pus found; rather free bleeding. At home she is to use poultices. July 25.—Incision gave relief only for a few hours; patient passed a miserable night; canal this morning completely closed; ordered free use of Clarke's douche, with water at a temperature of 100° Fahr. July 26.—Douche gave decided relief, and patient was able to sleep the greater part of the night; slight watery discharge this morning; entire freedom from pain. Canal a trifle swollen. No subsequent trouble beyond an occasional twinge of pain.

Case X.—Male, thirty five years old and in a fair condition of general health. April 2, 1879.—Pain in the right ear since yesterday. It is now quite severe; orifice of meatus almost closed by inflammatory swelling. Redness and tenderness of mastoid integuments. Free incision through posterior wall; poultices. April 3.—Patient passed a poor night. Only partial relief from the pain. April 4.—Almost entirely free from pain; slight watery discharge. Subsequent recovery rapid.

Case XI.—Male, eighteen years of age, and in apparently vigorous health. August 21, 1877, steadily increasing pain in right ear for past two or three days. Has been more or less subject to earaches. External auditory canal nearly closed at its orifice by the swollen condition of its walls. Free incision. No pus found. Warm applications, either moist or dry, according to the patient's preferences. August 22.—Patient passed a comfortable night, and has had no return of the pain. Slight watery discharge. August 25.—No relapse. Ear practically well.

Case XII.—Male, seven years old, and of rugged appearance. December 21, 1876.—Chronic left otitis med. pur., since early childhood. Sharp pain began two days ago in left ear. Canal almost obliterated by a circumscribed swelling at junction of cartilaginous with osseous portion. Free incision gave escape only to blood. December 23.—Decided relief followed incision, and patient is now entirely free from pain. Deeper parts visible to-day. July 9, 1878.—Similar attack. Poultices alone used. Slow but steady amelioration of the symptoms, without formation of an abscess.

Case XIII.—Strong healthy colored woman. April 8, 1871. Exposure to cold two days ago, followed immediately by pain in the right ear. Leeches applied, but with little or no success. Pain to-day severe; meatus almost closed near orifice. Greatest tenderness posteriorly and superiorly. Free incision at this point at nine A.M. At half past seven P.M., pain having been relieved only for a short time, I incised the mastoid integuments. Speedy and permanent relief.

Case XIV.—Male, twenty-eight years of age, in good health. April 22, 1874.—Pain in left ear during the past six days. Motion of jaw painful. Abscess apparently forming at base of tragus. Canal nearly closed. He has had three or four similar attacks during past two years. Four leeches applied in front of tragus. April 23.—Only temporary relief; pain returned before night, and continued with great severity through the night. Free incision through the swelling in the canal. April 24.—Better; parts still somewhat painful. April 27.—Quite well again.

Case XV.—Female, thirty years of age, in robust health. April 13, 1875. Pain in right ear during past five days. Tenderness on pressure, chiefly in front of tragus. Meatus almost closed by swelling of its walls; tenderness most marked when pressure is made upon the anterior wall. Two leeches applied in front of tragus. April 14.—Only temporary relief afforded by leeches. Motion of jaw painful; ordered poultices. April 15.—Still in great suffering. Ether administered, and free incision made in anterior and lower part of meatus. No pus found; three leeches also applied in front of tragus. April 16.—Patient passed a very comfortable night without an opiate. Rapid recovery followed without further return of pain.

Case XVI.—Female, twenty-four years of age, in robust health. September 3, 1875.—Pain began in left ear three days ago, and has now become quite severe. Canal nearly closed by swelling of its walls near the orifice. Two leeches applied. September 4.—Entire relief from pain. Bleeding from leech-bites continued for several hours. September 10.—Pain has returned and is now very severe. Free incision of anterior wall, which is the part most decidedly tender and swollen. No pus; very little hemorrhage; relief from pain in half an hour. September 11.—Patient passed a good night. Subsequent recovery rapid.

Case XVII.—Female, twenty-eight years of age. August 17, 1870.—Pain in right ear during past few days. Furuncles in outer half of right external auditory canal: tenderness on pressure over mastoid process, and in front of the tragus. Ordered three leeches, and ear to be douched with warm water. August 20.—Patient entirely free from pain. September 28.—Another abscess forming. Incision. Patient to return, if pain should persist. She was not seen again.

Case XVIII.—Male, twenty-four years of age, mechanic. July 17, 1872.

Pain began in left ear three days ago. No marked lesions in the external auditory canal; pain and tenderness being located chiefly in front of the tragus. Ordered three leeches. July 18.—Left meatus almost closed by swelling of its walls. Tenderness over mastoid process. Free incisions, one in upper wall, one in posterior. July 20.—Much less pain since last date; tenderness on pressure is only slight. Canal filled with pus. July 31.—Slow recovery. To-day parts are nearly normal.

An analysis of the results obtained by incisions in these seventeen cases, shows that in eight, or nearly half of the entire number, decided and permanent relief from pain was obtained; that in three the pain subsided only very gradually; and that in six, or over one-third of the entire number, no relief, or, at most, only temporary relief, was afforded by the incisions. It will be noticed that in a large majority of the cases the hot douche, poultices, or leeches were also used, either just before, or shortly after the operation. How far this additional local depletion aided in making the showing as favorable as it is, it would be difficult to determine. Admitting, for the moment, that they exerted no influence whatever, and that the incisions alone deserve the credit of the relief obtained in the eight cases mentioned, would we be justified, from this showing at least, in advocating Von Troeltsch's practice of "incising furuncles at the earliest moment practicable?" To answer this question fairly we should first ascertain what is the average course observed in those cases in which the knife is not used,—cases which are either left to themselves, or which are treated by leeching, or by the application of warmth and moisture in the form of poultices or the hot douche. Eleven of the twenty-eight cases referred to at the beginning of this paper belong to this category, and may properly be used for the purposes of our present inquiry. The knife was not used in one of these cases, and yet the onset and earlier stages of the disease were, on the average, fully as severe as in the first group of seventeen cases. In some of them the patients themselves objected to the employment of the knife; in the others, I myself had too little faith in its efficacy to urge upon the patients the wisdom of resorting to its use. In view of the monotonous sameness of the histories of these cases, I may be permitted to omit the individual details, and simply state the re-

sults of the comparison which I have made between the two groups. From this comparison I find that, in the eleven cases which were not treated by incisions, the painful stage was, on the average, no longer than that observed in the seventeen cases, where incisions were employed for the very purpose of shortening the duration of the pain. The average duration of this stage in both classes of cases, is, roughly estimated, from five to seven days.

If we seek for the reasons why incisions are so uniformly successful in cases of whitlow, and so uncertain in their effects in acute circumscribed inflammation of the auditory canal, we shall find that the chief and perhaps the only reason lies in the fact that the anatomical relations of the two parts are wholly different. In the case of the finger, the incision is at once followed by a certain amount of gaping of the wound; there is complete relaxation of the parts. In the case of the auditory canal, a comparatively unyielding cylinder of cartilage surrounds the inflamed tissues and renders relaxation of the parts almost an impossibility.

With regard to the other means of relief mentioned at the beginning of this paper—leeches, the douche, poultices, or dry heat—the same thing may be said as with regard to incisions. In a certain proportion of the cases they seem to afford great relief, and in almost all they at least mitigate the severity of the pain. Leeches, it is true, occasionally aggravate the pain, and the same may be said even of the douche; but in the main I have experienced better and more uniform results from the latter remedy than from any other of the different therapeutic means mentioned. All of these measures, however, are quite painless in themselves, even if they fail to afford the desired relief. Hence we need never hesitate about the propriety of using them. Incisions, on the other hand, are a great terror to very many people, and call for unusual efforts of courage on the part of those who submit to them.

Finally, the conclusions at which I have arrived with regard to the comparatively small value of incisions in this particular class of cases, are simply corroborative of the views held by some of the earlier writers on otology. Erhardt, for example, says: "It is decidedly better to allow the abscess to open by natural processes

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than to accomplish this end by surgical interference."[1] Bonnafont says: "In private practice the use of the knife always frightens the patient; and unless the case is a very urgent one, and the patient himself is desirous to have the incision made, it is much better to allow the abscess to open of itself."[2] Finally, Wilde says: "As soon as we believe matter has formed, and come some way to the surface, but not till then, we should make an incision."[3]

In conclusion, let me sum up briefly the relative merits of the different measures most commonly employed in the treatment of acute circumscribed inflammation of the external auditory canal:

1. Incisions cannot be depended upon to give permanent relief from pain, or to materially shorten the course of the disease. They should therefore be used only after local blood-letting or hot applications have been faithfully tried without success, or where the appearance of the inflamed part indicates the probable formation of a collection of pus.

2. The application of heat is preferable to local blood-letting by leeches.

3. Of the various means at our command for applying heat to the inflamed part, the pleasantest, and at the same time the most effective, is the hot douche. In a few cases, however, the patient finds some form of dry heat more effective in relieving the pain.

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[1] Vorträge ueber die Krankheiten des Ohres. Leipzig, 1875, S. 160.

[2] Traité théorique et pratique des maladies de l'oreille. Paris, 1873, p. 188.

[3] Practical Observations on Aural Surgery. Philadelphia, 1873, p. 192.

A SIMPLE MODIFICATION OF THE HAND-ATOMIZER.

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Learning upon inquiry that a modification of, or rather addition to, the atomizer in common use has not been very generally adopted, I submit it with the hope that it may prove of that value to others which I have found it to have for myself.

For a number of years Leslie & Co., of this city, at my suggestion have drilled a hole in the upper aspect of the shoulder of the small bottle used as part of the atomizing apparatus. The position of this opening is such that it is readily covered by the tip of the forefinger of the hand holding the bottle. I refer to the apparatus in common use—that with glass or hard rubber tube and rubber bulb, or bulbs to be compressed by the hand. This most useful instrument has a serious disadvantage, as is often discovered when, for instance, in spraying the throat with irritating solutions, the patient suddenly withdraws the head, allowing the spray to be thrown into the mouth, or to bespatter the face or clothing. The continuous emission of the spray due to maintenance of pressure within the bottle by the contraction of the elastic tubing, makes such a result inevitable, unless a means is provided for the instant relief of the pressure. This is accomplished by means of a safety opening, such as that here advised. On lifting the covering finger the compressed air escapes from the bottle, and the emission of spray of course instantly ceases.

For the purpose of protecting the covering finger from contact with staining solutions, and for greater convenience in closing the opening, a disc of sheet-rubber may be wired to the neck of the bottle, in such a position as to cover the safety-vent.

The necessary opening in the bottle is easily made, if the proper glass-drilling apparatus is not at hand, by making two shallow cross-cuts upon the glass with an ordinary file, and completing the opening at the junction of the cross-cuts, by means of a rod of wood tipped with moistened emery, and used as a drill.

BOOK NOTICES.

The International Congress of Medical Sciences held its session this year at Amsterdam, on the 8th of September, and following days. The Section of Otology was organized by the election, by acclamation, of Drs. Delstanche, Voltolini, and Guye, as honorary presidents. The first paper read was a report on Diseases of the Ear in their Bearing upon the Subject of Life Insurance, by Dr. J. Patterson Cassells, of Glasgow. A communication was also made by Dr. Lawrence Turnbull, of Philadelphia, on the subject of The Different Forms, Causes, and Treatment of Tinnitus Aurium.

On the following day, the 9th of September, Prof. Voltolini exhibited to the members of the Section some instruments intended for galvano-caustic purposes. Two reports were then read: one by Dr. Magnus, of Königsberg, on The Different Methods of Determining the Acuteness of Hearing; and the second by Dr. Guye, of Amsterdam, on The Vertigo of Ménière.

The next session was held on the 11th of September, and two reports were made: one by Dr. Delstanche, on a case of foreign body (stone) introduced into the middle ear through a tear in the membrana tympani, with subsequent healing of the perforation through which the stone had passed; the other by Dr. Ménière (a son of the physician who first described the group of symptoms since known under the name of Ménière's disease), on acute mastoid periostitis, consecutive upon various forms of inflammation of the external auditory canal, and uncomplicated by any disturbance in the middle ear.

On Friday, September 12th, Dr. Doyer, of Leiden, read a paper on Adenoid Tumors of the Naso-pharyngeal Cavity. The official programme published the conclusions of only Doyer's, Guye's, Magnus', and Cassells' papers. They are as follows:

Naso-pharyngeal Adenoid Tumors.—1. Adenoid tumors of the nasal pharynx are often an unrecognized cause of a series of disturbances of the functions of respiration, speech, and hearing,—disturbances which cannot be rectified, at least in the majority of cases, except by extirpation of the tumors.

2. Respiration through the mouth should not be looked upon merely as the *effect* of these tumors, or of the catarrhal swelling of the naso-pharyngeal mucous membrane; as soon as it has become an habitual thing, it should be considered as, at the same time, a cause tending to promote the development of the tumors, or to induce a recurrence where they have once been removed.

3. In the majority of cases these adenoid growths may be completely removed by the finger-nail of the operator, and this method, by reason of its simplicity and general applicability, should be preferred to that which requires the use of instruments.

The Vertigo of Ménière.—1. In the broadest sense of the term, the vertigo of Ménière may be considered as including all those cases of vertigo which are due to an abnormal irritation of the nervous apparatus of the semicircular canals. The irritation may be due to a cause which is merely an exaggeration of what must be considered as normal—*e. g.*, an intense rotatory movement of the head or of the entire body; or it may be due to an abnormal cause, such as a sudden change of temperature (generally a depression), variations in intra-tympanic pressure, and circulatory or inflammatory disorders.

2. In a more restricted sense the term Ménière's disease has reference to those cases in which an inflammatory condition of either the semicircular canals or the middle ear (tympanic cavity or mastoid antrum) gives rise to a vertigo that may either be constant in character, or may only appear when normal movements of the head are made, or, finally, may only occur in the form of paroxysms, separated by intervals of weeks or even months.

3. Cold and catarrhs of the tympanic cavity play a chief part in the etiology of Ménière's disease.

4. The majority, if not all, of the cases of Ménière's disease are secondary in their nature, *i. e.*, they are caused by catarrhal or inflammatory processes in the tympanic cavity or mastoid antrum.

5. In typical cases, the vertigo is accompanied or preceded by sensations of rotation, which follow each other in a regular order, as follows: the attack begins with a sensation of rotation around a vertical axis, and always *in the direction toward the affected side*; at times the rotation partakes of the character of a to-and-fro movement. Then follows, in grave cases, a sensation of rotation around a frontal axis, forward and backward; afterward the vertigo becomes general, and the patient falls to the ground, with or without loss of consciousness. Frequently he is attacked with vomiting. In certain cases the paroxysm terminates at the end of from ten to thirty minutes; in others, during the following twenty-four or forty-eight hours, the vertigo returns whenever the head is moved, and the patient is therefore compelled to keep his bed.

6. In a few cases, the sensations of rotation may be produced by certain therapeutic acts: for example, by insufflation of air into an acutely inflamed tympanitic cavity, or by the injection of liquid into the mastoid antrum after perforation of the mastoid process. In these cases the sensation is always that of rotation around a vertical axis, the movement being *in the direction of the affected side.*

7. In certain cases the paroxysms are accompanied by very marked subjec-

tive noises; in others, there is a constant, slight buzzing noise, which does not increase during the paroxysm; in a few cases, finally, all subjective sensations of sound are lacking.

8. In cases of long standing, a slight sensation of vertigo continues during the intervals between the paroxysms, and is generally brought on by the movements of the head first made after awaking from sleep. The patient sometimes experiences a sensation as if he were falling either forward or backward. Other patients are compelled to maintain their heads in a certain fixed direction, as otherwise every movement, in the plane of any one of the three semicircular canals, produces a sensation as if a heavy body within the head followed the direction of this movement. (In a well-marked case, which came under my observation, the patient held his head inclined forward and toward the left, thus preventing every movement of rotation in the plane of the vertical semicircular canal of the left side. The left was the affected ear.)

9. Aside from the complications with hysteria, which are not at all rare, Ménière's disease produces quite often in children a condition strongly resembling chorea, and in adults clonic contractions of the muscles of the face and of the body, which may entirely disappear under local treatment directed to the middle ear.

10. Ménière's disease often terminates in recovery, with or without loss of hearing.

11. Local treatment often proves successful in cases which have not become too chronic.

12. With regard to internal treatment, the employment of quinine, as recommended by Charcot, commends itself most strongly to our judgment. The paroxysms are often postponed by the continuous employment of this remedy. It may be mentioned as an interesting fact that, in patients who are suffering from an affection of the internal ear, quinine sometimes produces the paradoxical effect of arresting the tinnitus, while at the same time it augments the deafness. This action is generally limited in duration to the time during which the quinine is being taken.

The Different Methods of Determining the Acuteness of Hearing.—1. The different methods of testing the acuteness of hearing must be judged according to the object which the examination was intended to accomplish, and not in accordance with any ideal standard. None of the existing apparatuses meets wholly the requirements of a general test.

2. It is possible to examine each ear separately with regard to its power of distinguishing irregular noises. This cannot be done, however, with the same degree of accuracy where regular sonorous waves (music) are employed as a test.

3. For the purposes of medical diagnosis such methods are required as will

enable the physician to compare the acuteness of hearing for sounds transmitted through the air with that for sounds transmitted through the cranial bones. The watch and the tuning-fork supply this want.

4. For purposes of prognosis and as a guide in treatment it is necessary to have an instrument which produces a sound of constant intensity (Politzer's acoumeter, the watch).

5. A stop-watch is perhaps the best instrument for medical purposes.

6. All measurements of the acuteness of hearing possess only a relative value. This may be attributed in part to subjective influences (attentiveness, age, intelligence), in part to objective (strange noises during the examination, the locality in which the test is made).

7. Every physician should determine what is the normal hearing distance under the circumstances peculiar to his own surroundings, and should then consider this as unity. He may then express the results obtained in testing different degrees of acuteness of hearing by fractions of this unit.

Diseases of the Ear in their Bearing upon the Subject of Life Insurance.—1. It would be manifestly unjust to reject all cases of deafness or otorrhœa, without making a distinction between them. We possess no data which show that diseases of the ear diminish the average duration of life in general.

2. All applicants for life insurance should be questioned with regard to the past history and present condition of their ears.

3. Those individuals who have had some disease of the ear should be examined by an expert in this branch of medicine.

4. The object of this examination is to determine the degree of risk attributable to the disease of the ear.

5. Simple disturbances in hearing and uncomplicated otorrhœa in otherwise healthy individuals are not sufficient causes for the rejection of a risk. On the other hand, it is proper to refuse cases where the existing otorrhœa originated with one of the exanthemata, or where it is associated with a scrofulous or syphilitic taint; also cases where there is tinnitus aurium, with or without impairment of hearing, when the course of the affection is variable; finally, cases where the tinnitus (with or without impairment of hearing) is complicated by a syphilitic taint.

Three other contributions are mentioned in the official programme, but no analysis is given. The titles are as follows:

1. The Mastoid Region and Process: its Diseases, with Illustrative Cases. Dr. Lawrence Turnbull, of Philadelphia.

2. A New Method of Removing Adenoid Growths. Dr. Victor Lange, of Copenhagen.

3. Tinnitus Aurium: Pathogenesis and Treatment. Prof. Edw. Giampetro, of Naples.

A Case of Luxation of the Inferior Maxilla above and into the Temporal Fossa. Thèse par Paul Neis. Paris, May 29, 1879.

This thesis is upon a rare form of surgical injury, and finds its interest for the readers of this journal in the fact that the lesion was followed immediately by a hemorrhage from the ear. The circumstances were as follows: A young fisherman, while leaning far over the side of a small-boat attached to a large ship, was caught between the two so that his head was pressed for a few moments, the line of pressure running from the occiput to the chin. At the moment of pressure the lad felt a sharp pain and heard quite a loud cracking in his left ear, but there was no loss of consciousness nor confusion of intellect.

Disengaged from this awkward position, he got up easily, but perceived that he could not open his mouth, that the inferior dental arch was carried back of the upper, and that he was losing blood from the left ear. This hemorrhage was inconsiderable, being only a trickling which lasted a few hours.

Thirteen days later he was examined by Dr. Neis, when it was discovered that there was some diminution of hearing in the left ear, in the canal of which there was dried blood. Although there was no clot of blood in the canal, an examination of the drum-head was not possible, says the candidate; but we are not informed why it was impossible.

The patient in the end made a perfect recovery.

Luxation of the lower jaw upward is generally regarded as impossible by all authors; hence, the candidate regards the case he has given as one of sufficient rarity to report, and to make the basis of his thesis. There are, then, eleven illustrative cases given from French surgical literature, nine of which are from the pen of Dr. Morvan, of Lannilis. An examination of the symptoms in these cases reveals that an injury of the chin, otorrhagia, with more or less hardness of hearing, pain and swelling of the temporo-maxillary articulation, difficulty or even impossibility of opening the mouth, are signs by which we may recognize fracture of the glenoid cavity. In some cases, to these symptoms may be added difficulty of deglutition.

At the Forty-Seventh Annual Meeting of the British Medical Association, held in Cork, August 5, 6, 7, and 8, 1879, a subsection of Otology was organized—a step that gave a fuller recognition to this department of medicine than had existed heretofore. At the meeting were otologists of many nationalities. The Honorary Secretary of the Otological Subsection, in extending an invitation to the otologists of the United States, also invited them to contribute some communication, or to take part in the special discussions; he also tendered a hospitable reception to any of them who should visit Cork for the purpose indicated.

The subjects for discussion before the subsection were: 1. The Therapeutic

Value of the Intra-tympanic Injection of Medicated Fluids in the Catarrhal Affections of the Middle Ear.

2. Tinnitus Aurium.

The *British Medical Journal* for August 30, 1879, contains an account of the proceedings.

Dr. Cassells, of Glasgow, in opening the work of the subsection on Wednesday, August 6th, remarked that the subject of otology on that day received for the first time a distinct recognition in the proceedings of any medical congress in Great Britain; although on the Continent of Europe and in the United States of America it had long been distinctly recognized in every great medical gathering. To the speaker it was inexplicable that it should have remained so long unrecognized in Great Britain, where scientific aural surgery had its birth, and still has its home, notwithstanding the immense and valuable labors of his *confrères* on the Continents of Europe and America.

The speaker regarded Saunders as the first to lay down the principles of conservative aural surgery; Toynbee was the founder of aural pathology, and might justly be called the father of British aural surgery; Wilde had advanced the subject of aural therapeutics as no one had done before him; and Hinton had gathered up the sum of the labors of his predecessors, so that it had been said of his works in this department that "they will serve as stepping-stones for others to rise upon;" he had not, however, the satisfaction of seeing the subject of otology recognized as it is, happily for us, to-day.

The labors of the subsection were on the first day presided over by Dr. Laurence Turnbull, of Philadelphia.

The first paper presented was entitled, On the Production of Artificial Deafness, being an experiment in Physiological Acoustics, and its bearing on the Etiology and Evolution of Diseases of the Ear, by Dr. Cassells. The object of the paper was to show the effect on audition and disease of tympanic tension. Dr. Woakes, of London, read a paper on Throat-deafness associated with Paresis of the Palato-tubal Muscles, which was published in the *American Journal of Otology* for October, 1879. The paper was discussed by Dr. Weber-Liel, of Berlin; Mr. Lennox Browne, of London; and Dr. McKeown, of Belfast. Dr. Cassells followed with a paper on The Therapeutic Value of Intra-tympanic Injections of Medicated Fluids in the Catarrhal Affections of the Middle Ear. The author stated that he formerly used medicated solutions in the treatment of chronic catarrhal affections of the middle ear, having been favorably impressed with this method by the teachers from whom he had imbibed his knowledge of otology. After a few years' experience in this practice he came to the conclusion that the chief merit of this method consisted in the inflation by which the introduction of fluids in the middle ear was effected, and he had, therefore, abandoned their use for the last seven years.

The Honorary Secretary then read a paper on the same subject by Dr. Weber-Liel, which is published in full by the *British Medical Journal.* This author said that an experience of sixteen years in aural practice had forced him to relinquish the idea that intra-tympanic injections of medicated fluids might possibly cure inveterate catarrh of the tympanic cavity. The use of solutions of carbonate of soda, however, were considered by the author as likely to dissolve or soften intra-tympanic adhesions, etc., and, when used where these conditions were present, they were thought to have a good result.

A paper in much the same vein was read by Mr. Lennox Browne, who was even more decided in his objections to the method of treatment under discussion. Some discussion followed the reading of the last two papers, which was participated in by Dr. Cassells, Dr. Kirk Duncanson, of Edinburgh, and Dr. Pierce, of Manchester.

Dr. Cassells agreed with Mr. Lennox Browne in the advantage of injecting medicated liquids into the tympanum *per* the Eustachian tube in cases where the tympanic membrane was perforated by disease or by an operation. Dr. Duncanson thought that in these cases some of the fluid was likely to remain in the tympanum, the floor of that cavity being much below the floor of the meatus; he had been accustomed, however, to use injections both through the Eustachian tube and through the meatus, when the membrana tympani was perforated.

A paper was read by Dr. McKeown, on The Treatment of Relaxed Membrana Tympani. The writer takes the position "that almost all the evils resulting from affections of the tympanum arose from a drawing in or pushing in of the membrana tympani, and that the primary consideration in treatment should be to prevent this." The treatment recommended in these cases is the use of "some agent which, when applied to the membrane of the tympanum, would diminish its concavity, and therefore pull it out, and at the same time increase its resistance." Collodion was found by the author to answer this purpose. The author reports a case as benefited by this means. He also suggests that by its use adhesions of the membrane to the tympanic walls may be broken up; or the membrane itself may be ruptured. The application is also recommended to restore mobility to a rigid malleus, or to keep open an artificial perforation, or to prevent adhesions in cases of recent catarrh. The paper was discussed by Dr. Pierce, and Dr. Macnaughton Jones, of Cork; in reply to a question by Dr. Jones, the author stated that no harm was likely to arise to the walls of the meatus, as the collodion would not stick to them. The application to very small points was useless. It was used only when wanted to cover a considerable surface; the collodion was found adherent in one case at the end of three months.

The chair of the subsection was, on August 7th, taken by Dr. Fitzgerald, of Dublin. At the opening of this day's session, Dr. Browne exhibited an audi-

ometer, suggested by Professor Hughes, as an exact test of hearing. The use of the instrument was discussed by several of the gentlemen present, and, from what the writer can gather from the report of the proceedings, it was concluded that the instrument did not answer the purpose of aurists as a practical test for hearing.

At this session of the subsection, Dr. Bonnafont, of Paris, brought before the subsection the subject of the perforation of the tympanic membrane, a matter in which he has for a great many years been much interested—even hoping to establish a return of hearing after this operation, as promptly as sight is restored after an operation for cataract. His present method consists in rendering the membrane insensible by Richardson's apparatus, and then perforating by means of the actual cautery—the points used consisting of pencils composed of charcoal and dragon's blood. As far as the writer can learn, this subject is in about the same attitude as when its enthusiastic author launched it forth.

Dr. Pierce reported nine cases of aural exostosis, all of them being males. In five cases the development was found in both ears, and there was no history of rheumatism or gout. In two cases there was a history of syphilis. In three of the cases there was discharge; and two of these were accompanied by polypi. The exostoses were "almost" wholly non-pedunculated. Dr. Cassells said, respecting the etiology of these growths, that "a subperiosteal abscess formed over the mastoid, made its way out in the line of least resistance, and discharged; from and around the opening, vascular granular growths sprouted up and increased in size, becoming at the same time changed into bony tissue from the conversion of their cells into bone-cells.

On Friday, August 8th, Dr. Cassells occupied the chair. A paper was read by Dr. Löwenberg, of Paris, on Fungous Ear Disease. The subject was discussed, and among other views expressed was the belief that uncleanliness and humidity were nearly always the important factors.

Tinnitus aurium was next discussed, the subject being opened by the presentation of a paper by Dr. Turnbull. Mr. W. Douglas Hemming also read a paper on this subject. Some discussion followed, but nothing was advanced that seemed to present an explanation of all of the physical causes of tinnitus aurium. Most, if not all of the matter offered, was collected from the well-known literature of the present decade—the original observation referred to by authors being rather confirmatory in their nature than new.

The following papers were taken as read:

On the Occurrence of Exostoses within the External Auditory Meatus in Prehistoric Man. By Clarence J. Blake, M.D. (Boston).

Ear Diseases and Life Assurance. By J. Patterson Cassells, M.D.

Note on Tinnitus Aurium. By Samuel Sexton, M.D. (New York).

I. Inflammation in Cases of Cleft Palate, both before and after Staphylor-

raphy; II. Chloroform Vapor in Inflammation of the Middle Ear. By C. S. Turnbull, M.D. (Philadelphia).

In reviewing the work of this meeting of otologists it is evident that the doctrines held a short time ago as of vital importance, as to the value of intra-tympanic injections, for instance, no longer retain undisputed control of the aurist's mind. The work of the subsection showed great activity in the field of clinical observation, and we should have been gratified had there been evinced an equal degree of interest in physiological acoustics and anatomical research, both pathological and normal.

REVIEWS.

On the Present State of Experimental Acoustics, with Suggestions for the Arrangement of an Acoustic Laboratory, and a Sketch of Research. R. H. M. Bosanquet: St. John's College, Cambridge. *Philosophical Magazine*, Oct., 1879, p. 290.—In this paper the writer presents an outline of suggested arrangements and work for an acoustic laboratory, which he hopes shortly to be able to carry out.

As the paper deals largely with descriptions of apparatus for the accomplishment of the proposed purpose, it would be impossible to do it full justice without reproducing a large part of it, and the reader is therefore referred to the paper itself for details, which are included under the following headings: Aërial Mechanics, Vibration Numbers, Revolving Stopcock, relating to the class of investigations which depend upon the regular opening and closing of a channel, for the interruption either of a current of wind or of a current of sound, reference being had to the experiments of Prof. A. M. Mayer in regard to the phenomena presented to the ear listening to a sound through the interrupted channel, and to determination of velocity of sound in open air for different musical notes, by a process bearing some analogy to Fizeau's determination of the velocity of light by reflection from a distance; Reeds, Strings, Orchestral Instruments, Changes of Temperature, Velocity of Sound in Tubes, Quality of Organ-pipes, Sympathy and Drawing, Loudness of Sound, Mechanical Equivalent of Sound. "The subject of the measurement of the loudness of sound will," says the author, "receive a new foundation in the admission of Fechner's psycho-physical law, with respect to the perception of sound by the ear. This law is derived from the admission that equal fractions of any existing mechanical intensity produce equal impressions; and it results in the statement that the impression is the logarithm of the mechanical intensity. Under these circumstances impressions have to be classified as to apparent loudness, in the same manner as stars are classified as to apparent brightness. The criterion of successive stages is that they appear equally distinct from one another when loudness only is considered." Phonograph and Phonautograph, Electro-pneumatic Clock Governor, Pneumatic Motors, Bellows of Precision.

In the introduction to this paper, the concluding sentence of which is worthy of notice, the author says, with much truth: "Experimental acoustics are at present in a condition which is perhaps not entirely satisfactory. In the teaching of the subject, there is occasionally more demand upon the faith

of the learner than is altogether desirable in an experimental science. In the author's opinion, this arises from the difficulty of access to those experiments which deal with the foundations of the science. The prices charged for complete sets of acoustic apparatus are enough to show that the possession of such apparatus must be confined to few. Adequate sets of such apparatus, used in a sufficient and convincing manner, are exceedingly rare. Under these circumstances, that full experimental knowledge which is desirable in a science of this description does not generally exist.

"The ordinary apparatus aud arrangements for demonstration appear to err in some points. The effects are not produced in a continuous manner, but by fits and starts, generally by bowing on the sounding body. We do not analyze with ease and certainty a phenomenon which only preseuts itself to disappear again. These intermittent phenomena are generally produced by an effort, often requiring considerable skill. Under these circumstances there is a tendency to accept the first conclusion that comes to hand, the mind being to some extent satisfied with the production of the difficult phenomenon.

"Again, it has become, perhaps, too much the practice to refer the phenomena to optical analysis or analogy. In some cases this reference is, no doubt, most convenient; in other cases it is misleading. It is requisite that the analysis of the perceptions of the ear be conducted by reference to the ear itself."

The Audiometer. E. Hospitalier: *La Lumière Electrique*, Paris, T. I., No. 3.—This instrument, intended to be used as a precise measure of the hearing power, consists of a graduated insulated bar thirty centimetres long, having at either end a bobbin of wire. The bobbins differ in size, the smaller having a coil of wire nine metres long, and the larger a coil one hundred metres long.

These bobbins are placed in circuit with a small battery—three Daniell or Leclanché cells—and a microphonic key or a microphone placed upon a small clock or other constant sound source. The circuit, therefore, is formed by the battery, the microphone, and the two bobbins. A third bobbin, sliding upon the graduated bar, carries, also, one hundred metres of wire, the ends of which are attached to a telephone.

The principle of the audiometer is based upon the physical fact that when the battery is in action and a current is passing through the two stationary bobbins—primary coils—a current is induced in the movable bobbin—secondary coil—in proportion to its approximation to one or other of the primary coils, and the sound from the microphone is heard in the telephone, attached to the secondary coil, with proportionate loudness. If the two primary coils were of the same size, the zero point on the graduated bar, at which no sound would be heard when the secondary coil was placed upon it, would be in the centre of the bar; one of the primary coils being made smaller than the other,

however, the zero point is nearer the smaller coil and a greater length of the bar is at service for the use of the graduated scale.

The instrument is used by applying the telephone to the ear to be tested and sliding the secondary coil along the graduated bar. At a certain point between the two primary coils, and nearest the smaller, the inductive effect of one balances that of the other, and no sound is heard in the telephone. On sliding the secondary coil toward the larger primary coil, the sound steadily increases in loudness until the maximum of approximation is reached. In this instrument the space between this point and O is divided into 200°, representing units of sound, or two hundred gradations between a limit at which any one who can hear at all can hear the sound through the instrument, and at a point at which there is no sound.

In presenting this instrument of Prof. Hughes before the Royal Society, Dr. Richardson detailed some of his experiments therewith.

Fifty tests made in as many cases gave nearly all the degrees of perception from that at 1°, representing a delicate perception, to 200°, representing nearly absolute deafness. The average ear tested by the audiometer corresponds to a grade of from 4° to 10°. As a rule, right-handed persons hear better with the right ear and left-handed persons with the left ear; on the other hand, persons accustomed to listen with the left ear—physicians in auscultating, and the like—hear better with the left ear. Experiments were also made upon the effect of respiration, of atmospheric pressure, and of the general bodily condition upon hearing.

The instrument is so sensitive that the displacement of the bobbins half a degree renders the telephone silent.

The Pseudophone. Prof. S. Thompson: *London Graphic*, Sept. 27, 1879. —At the last meeing of the British Association, Prof. Thompson exhibited an instrument devised for the study of illusions connected with the sense of hearing, an illustration of which is given in the *Graphic* of the above date.

The instrument consists of two small circular boxes, which can be fitted over the ears by means of two adjustable metal bands, one passing over the top and the other over the back of the head. In the centre of the bottom of each box is an opening to admit the sound, and hinged to the bottom of each box, behind the opening, is a small projecting flap, which can be placed at any desired angle. These flaps can also be turned upon their circular supports by revolving the bottom of the box to which they are attached, so that they can be arranged to reflect sound into the ears from any direction; and as each is independent of the other, they can be so turned as to reflect into each ear sounds from different sources.

The deceptions induced by this instrument as to the source of a given sound are most perplexing, and it may be made of service in connection with a line of physiological investigation which is now commanding much interest.

On the Sensibility of the Organ of Hearing. W. Kohlrausch: *Wiedemann's Annalen*, 1879, No. 6; *Phil. Mag.*, No. 48, September.—With the aid of a toothed wheel working against a disk of metal or pasteboard, Savart found that two impulses can make upon the ear the impression of a comparable tone. Exner (Pflüger's Archiv, XIII., p. 228), by means of tuning-forks vibrating before spherical resonators, finds that seventeen impulses, Pfaundler (*Wiener Berichte*, LXXVI., p. 572, 1877), by experiments on holed sirens and reflection-tones, that only two impulses, and Auerbach (*Wiedemann's Annalen*, VI., p. 591, 1879), that about twenty vibrations, are necessary for the production of a tone in the physiological sense, the tone being determined to within the interval 100 : 101. Less sharply defined tones can be produced in a simple manner by but two impulses. Two fingers of the hand being held together so that the ends of the finger-nails are on a level, a blow is given therewith somewhat obliquely upon a table or board, the proper tone of which is deadened by loading it with books or some other heavy substances. It will be readily felt that the two fingers rarely strike simultaneously, and by a little attention there will be heard, with the noise of the blow, a very hollow tone of a pitch which changes *per saltum* according to the position of the fingers, but which, by practice, can be approximately had at command. Similar tones are obtained by running the finger-nail over short lengths of ribbed paper.

A Curious Acoustical Illusion. *Telegraphic Journal*, London, Sept. 15, 1879.—This illusion, pointed out by M. Plumaudon, of the Puy de Dôme Observatory, has also been observed by others who have made use of a pair of telephones in receiving messages or in experimental research.

With a single telephone held, say to the right ear, the transmitted voice appears to come from a distance to the right; while with a telephone held to the left ear, it seems to arrive from the left of the listener.

With a telephone to each ear, if one ear be less sensitive than the other, or if the telephone be held farther from that ear, the voice apparently shifts to the side of the other ear; and if both ears hear alike and both instruments are equally near their respective ears, the voice apparently proceeds from in front of the observer.

The Education of Deaf-Mutes. By M. Coldefy, Professor in the National Institution (France) for Deaf-Mutes. *Annales des Maladies de l'Oreille*, etc., Nos. 1, 2, 3, 1879.—This article sets forth the supposed merits of the more ancient method of instructing deaf-mutes by signs.

The system originally founded by the Abbé de l'Épée in France, is still adhered to by many of the schools in that country, where the sign-language is held to be the natural language of the mute, and, therefore, the best whereby to accomplish the moral and intellectual development of such children.

It appears from this article that the Abbé de l'Épée did not exclude articu-

lation from his system, though the prevailing report is that he did. He, however, simply regarded speech as only a complement of, and not the means of instruction.

This was not the opinion, however, of his distinguished rival, Samuel Heinicke, of Leipzic. He adopted speech as the means and as the end of his instruction of congenital deaf-mutes. Nevertheless, even in some of the German institutions of the present day, speech is no longer considered the essential element in instruction of the deaf-mute, but sign-language is held to be the natural language of the deaf-mutes, and is recommended in some of the congresses as the most certain method of intellectual and moral development in these children.

Articulation and the sign-language are not two inimical brothers, but, on the contrary, they are formed so as to lend each other mutual support, since they both tend to the same result.

The course to be pursued in educating deaf-mutes is pointed out by nature, and is to be seen in the manner in which a hearing child learns the language of his country. A child endowed with all his senses, learns his mother-tongue from the cradle, without art, and by the effect alone of the circumstances in the midst of which he is placed. He learns it unconsciously, and even those with whom he is surrounded and who aid him, are almost unconscious of the process. Speech is the means, sight and hearing the instruments. With the faculty of attention memory is aroused. Then those who have the care of the child teach him the name of persons and things, placed before his eyes or under his hands. And this forms the first step in systematic and fundamental instruction given really with design. When the infant begins to execute a small number of actions, the terms to express these are repeated a number of times while the child performs them, either while encouraging him to continue or in advising him to desist. Some gestures, the play of the countenance, and vocal inflexions, aid in conveying the meaning. Thus, the child to whom we say "Come," while stretching out to him our arms, understands instantly the meaning contained in the word of invitation.

During all of this early period the ordinary child learns spoken language by noting the agreement between the observations made at the same moment by his eye and his ear. Having traced thus far the process of learning language in the hearing child, M. Coldefy then proceeds to lay before the reader the principle on which rests, in his opinion, the instruction of deaf-mutes. This principle he considers very simple, since it consists in teaching language directly by means of *written signs*, *i. e.*, to make writing play immediately the part that speech plays in ordinary instruction.

In order, then, to teach a deaf-mute the language of his country, writing defined by gestures and drawing, to which, later, speech may be added, must form the means of conveyance, and sight becomes the instrument of reception.

The endeavor must then be, by these methods, to do for the deaf-mute, with system and reflection, that which is accomplished almost hap-hazard and unconsciously for the hearing child. It is also important to begin the instruction of a mute at an early age: say from six to seven years of age.

The deaf-mute possesses a natural language, one that is eloquent and expressive. This he forms for himself; but his language possesses precision and logic: it is based purely on analogy, and he is forced, in order to create it, to observe and reflect constantly in order to express himself so as to be understood.

But this language of gestures is not very easy to acquire, and, when mastered, does not provide the learner with the language of the world he is surrounded by. Nevertheless, such as it is, it forms the only means of communication between his teacher and the mute pupil. The deaf-mute is affected, like ourselves, by the presence of external objects. The impressions received by him, and the ideas he forms of them, are analogous to the ideas we form of similar things; but, to express ideas, we use words and he uses gestures. The task is thus indicated: we have to make him acquainted with and use our words, in order that he may employ them in expressing his ideas.

The special object in the instruction of a deaf-mute being an ordinary practical acquaintance with speech, all the early efforts of his instructor should tend to induce the unfortunate one to participate in the intellectual commerce which enriches each one with the thoughts of all.

The means of obtaining this end are:

1. Actions, drawing, and mimicry.
2. Writing, speech, and dactylology.

These two classes of means lend mutual support to each other in this sense, that drawing and the language of action serve to interpret speech, writing, and dactylology, since these latter are unable to produce any impression on the mind of uninstructed mutes.

Other principles on which rests the instruction of this school of teachers of deaf-mutes are as follows:

1. A mother-tongue is always learned by means of a language of action. Thus, a child hearing for the first time, "Shut the door," would not understand its meaning if he did not see the act performed instantly. The same order, placed for the first time before the eyes of a deaf-mute, would not be better understood if it did not receive prompt execution.

2. Language translates itself. When the deaf-mute has seen the written order, "Open a window," executed repeatedly before his eyes, there is no further necessity for the two facts to be done simultaneously before him, since the written order recalls the action, and vice versa.

3. Language is decomposed by use—*i. e.*, "Shut the door," "Open a drawer," becomes, by experience, "Shut the drawer," "Open the door," etc.

4. Grammar is not to be spoken of to a deaf-mute learning his mother-tongue.

5. Grammar is insufficient to teach a language, simply because rules either precede examples or follow them; if they precede them, they are not understood, and if they follow them they are useless. M. Coldefy, then, considers the utility, the object, and the use of the language of gestures.

The writer rejects the accusation that gestures are taught the pupils in the institutions for the deaf and dumb. He says the truth is, the child comes to them with an undeveloped language, but which, by intercourse with his companions, is enriched by new expressions, and gradually acquires an extent which serves all practical needs.

The teacher seizes upon these gestures, which, though in part purely conventional, correspond in the mind of the pupil with ideas he is endeavoring to clothe with the expressions of our language. These signs cost the teacher nothing; he finds them already in circulation, and he uses them to teach the mute the acquisition of the language of his country. The language of signs has been accused of interfering with the acquisition of artificial language, on account of its different syntax. The adversaries of the sign-language attribute to it too wide an application in instruction, in order to show forth its drawbacks; and then they make a pretext of these objections to banish signs from instruction, or at least to assign it to very narrow confines.

The sign-language (*langage mimique*) is to be regarded in two different ways, viz.: in relation to the development of the intelligence; and secondly, in respect to the acquisition of familiarity with written language.

The mimic language is composed of signs of different kinds, viz.: natural, methodic, and a third variety founded in part upon nature and partly on analogy and convention. It is the true language of the deaf-mute and one of tradition, for the writer says he is unacquainted with any work in which it is described.

Some teachers, nevertheless, use, in the instruction of the deaf-mute, signs which are entirely natural, and they consider as such only those understood by every one. By means of a language of signs, deaf-mutes converse with each other, and thus communicate a mass of ideas transmitted from generation to generation, which are, so to speak, stored up in the mimic language. M. Coldefy says he is not entirely a partisan of the language of signs—far from it, in fact; and he is fully able to give each method its share of credit, but he at the same time is unwilling to exaggerate the objections. It is unwise, in his opinion, to renounce any instrument so useful, especially when it aids in the development of ideas and the constituent elements of speech.

When the intelligence of the deaf-mute shall have acquired a certain degree of development, and as soon as he shall have learned the value of expressions and the forms of our speech, and shall have tried to make himself

familiar with them, it then becomes necessary to restrain him in the use of signs, in order to make him express himself in the language of society. The farther the pupil advances in the knowledge of his new tongue, the less use he should make of the language of signs.

The mimic language, however, renders invaluable service in another direction. There is, unfortunately, in every institution a certain number of pupils who, though not deprived entirely of intelligence, are incapable of being instructed in our artificial language, but who can be taught a great deal by the language of signs. If the latter only conveys to these unfortunate ones moral instruction, it should thereby gain acknowledgment which would always insure its cultivation and use.

It is only when the deaf-mute is sufficiently a master of his language, to give some account of his impressions, that articulation can become in its turn a precious instrument in the acquisition of language, by putting into circulation the thought in the same expressions with which it is ordinarily clothed. In order to make a course of articulation really profitable to a deaf-mute, and to keep it from becoming a matter of fatigue, and perhaps disgust, wait until he can comprehend what you wish him to say with his voice or read on your lips. For it must not be forgotten that a child shows the more interest in a study the more active the part he takes in it.

The aim of all schools for deaf-mutes being to render the latter as much like the speaking person in intellectual power, and to place them in easy relation with the outer world, it would be culpable to neglect the teaching of speech as at least a complement of his education. But here arise several delicate questions, viz.: To whom shall the instruction be given? How shall it be conducted? When shall speech be made use of?

First, it is the teacher's duty to make a long and careful examination of the physiological and intellectual condition of his pupils, and to choose from them those most likely to be benefited by his care and his labors, and hence most likely to give satisfactory results: and by results is meant an articulation sufficiently distinct to render the phonetic efforts made by the mute easily perceived and easily performed. In a word, the child left to himself should be in a position to convey his thoughts by his voice so as to be easily comprehended. If this point is not attained, the results gained are laughable and unworthy the trouble their acquisition has required; nor do they repay for the precious time lost, which might have been spent so advantageously in clothing the mind of the child with knowledge more in conformity with his needs. If, as is too often the case, his speech is merely a kind of sputtering, what advantage can the deaf-mute gain from the use of sounds difficult to hear, and the utterance of which costs him efforts so little likely to encourage him?

If the advantages of speech as used by him in society are not demon-

strated to him—*i. e.*, if speech does not facilitate his relations with those who hear and speak—the deaf-mute will infallibly recur to writing as a surer, if even a longer method, of communication.

There is one class of deaf-mutes especially adapted to the exercise of speech, viz.: those who, having commenced life with hearing, know what the human voice sounds like, but who, from various causes, have lost their hearing in early childhood. Among congenital deaf-mutes are some with great intelligence and vocal power, having a timbre which gives hope that they may use speech with good effect; but it is impossible that all mutes can acquire the power of speech.

The vocal apparatus of the deaf-mute no longer having the ear to aid in directing it, remains in a state of forced inactivity, and consequently loses the suppleness and elasticity indispensable for the proper emission of sounds. Hence, the first efforts of the master should be to revivify in a measure these organs by a series of exercises calculated to regulate their play and to give them necessary vigor. In these efforts the easiest vowel-sounds render the best aid, and furnish a scale of sounds sufficient for the normal and progressive development of the voice of the deaf-mute.

It is not until the timbre becomes natural, and without the harsh and guttural tone so disagreeable to hear, that the pupil should begin to pronounce consonants, syllables, and the syllables composing words.

In order that this kind of exercise and instruction shall be of value, the teacher should be thoroughly prepared by a preliminary education in the pronunciation both of vowels and consonants, so that he fully understands the arrangement of the vocal organs best adapted to their emission. One teacher should not have a class with more than ten pupils in it, and even ten are many in the opinion of M. Coldefy.

Lip-reading being the counterpart of articulate speech, and in order to render it agreeable as well as useful to the deaf-mute, it is necessary to render the exercise one of intellectual satisfaction. This he will feel if he is already somewhat cultivated, and if what he is requested to pronounce is not unintelligible to him.

Lip-reading offers numerous difficulties to the French deaf-mute, because the French language possesses different orthographic values for the same sound. Nevertheless, it is more rational to teach the mute at the outset the sound-equivalents of the words he has just uttered, for he will learn without difficulty that there are several ways of representing and writing certain sounds.

It now remains for us to examine into the intellectual care which the deaf-mute should claim from the earliest age. His calamity consists in the entire isolation to which he is condemned from his birth. Though present, in a material sense, in the midst of his equals, he is deprived of all intellectual

intercourse with them. The blind person communicates with all and exchanges ideas with them; but the deaf-mute is alone in the world of thought.

Yet the deaf-mute has a share in our common nature, and even a little child anticipates our instructions, tries to read our looks, endeavors to express his wants, and thus indicates himself, by pantomime, the way by which to enter into communication with him. Here begins the task of his relatives, who are first called on to begin the work of rehabilitation of their child by preparing him for the education he is one day to receive.

There is recommended by the writer the phonomimic method of M. Augustin Groselin, as especially adapted for early instruction of the deaf-mute. This method consists in placing alongside, as it were, of every oral enunciation, a gesture intended to represent the sound to the eye. When applied to reading, which is the most important, a gesture of the hand or the arm translates each sound or each articulation pronounced by the mouth. The gestures, which are thirty-two in number, are very distinct, easy to make, and easily understood.

In this method of phonomimcry the sounds and articulations of the French language, being considered in some instances like sounds or cries of animated beings, and sometimes as onomatopeans, the results of natural phenomena, the author has been able to assume as the basis of his method of reading the impressions and the feelings of which these cries are the manifestation, and the acts which are the cause of these sounds, and thus he succeeds in presenting by short explanations, to the child, letters or groups of letters, not as being simply the written translation of an emission of sound, but as connected with facts which affect the eye and the ear. Thus, for example, the letter K, the child is told, is to be translated by the sound made by the young cock; that the letter S is the imitation of the hiss of the serpent; that the noise of the revolving wheel is the equivalent of the letter R; and that the letter U, is the reproduction of the sound the cabman makes in urging on his horse, etc.

Now, uniting the gesture to the sound for the letter K, the open hand is made to pass over the head in order to recall the cock's comb: for S, the undulations of the snake are imitated by the hand; for R, the revolutions of a wheel are imitated with the hand; and for U, a gesture of whipping the horse is used. Thus, as is easily seen, each letter is personified by a distinctive feature which must necessarily strike the mind of the child.

This method gives the best results when employed in large institutions, where it becomes a source of amusement as well as instruction. Hearing children learn this method very quickly, and are thus put in communication with deaf and dumb companions.

So far as concerns lip-reading, it will bring about the best results for the mute who is placed among hearing persons, for whom he is obliged to use phonomimicry, because such a child will be, so to speak, constantly incited

to observe the movements of the lips and to reproduce them, since the phono mimic gesture is almost always accompanied by a correspondent oral equivalent. These exercises would gradually accustom the child to seize the idea of other people from their lips, and would be a gradual approach to the acquisition of speech.

In conclusion the author says, he heartily approves of every endeavor, of the present day, to bring these great questions of education before the people. But he believes that all such expositions of various methods should be guarded, as absolute right and truth do not lie entirely on either side.

There is great room for discussion, but no one should condemn that plan with which he is entirely unacquainted. The author is unwilling to admit the principle of absolutism into education, and he therefore advocates the use of methods best adapted to reach a desired end, but not to confine oneself to any set rule.

An Examination at the Institution for Deaf-Mutes at Passy. *La France Médicale*, August 27, 1879.—M. Houdin, the director of the institution, explained the method he has been putting in practice for thirty years, and which has for its object to teach mutes to speak and to instruct them by speech. He further stated that the constant testimony of facts, as well as the scientific data, show that all intelligent deaf-mutes endowed with vision, the sense of touch, and an intact vocal organ, can speak, read speech on the lips of others, and can be taught by speech, and thus enter into communication with society. And he also remarked the superior position of the deaf-mute who has been taught speech, to that of the mute who can only make signs which nobody understands.

A child, six years old, was presented for examination. He read fluently, with a clear voice, words which were written for him on the black-board. He also named equally well all objects pointed out to him. He could also read from the lips all the words spoken to him, and wrote them on the board with a skill and rapidity quite extraordinary for a child of his age. He is able thus to read, articulate, and write all the words of the French language. He now uses, in ordinary phraseology, about 600 words, and, without doubt, will master the language and complete his education by this method of instruction.

Then followed an exhibition of pupils of three to four years of age, who read from the lips of others, spoke, and wrote from oral dictation. Madame Houdin dictated to them from a book, and they reproduced the text accurately without the least fault of orthography; and then they read aloud what they had written. Two of the pupils, young ladies, passed through the audience and answered intelligently and gracefully the questions put to them.

It was also observed that in these children the expression of face was lively and happy, which is quite different from what is usually seen in the deaf who

remain dumb. Their speech seemed natural, warm, expressive, and live, and not at all mechanical, cold, monotonous, and dead, as is often found in deaf-mutes who have learned to talk.

M. Houdin explained that this success was due not only to particular care as to the manner of speaking in private and family life, but also to the precaution taken to make not only one organ speak after being put into mere automatic motion, but to make the intelligence speak through that organ, which alone can give warmth, color, and life to speech.

There was then presented a young man, 16 years old, who had become totally deaf at 11 years of age, and who would have ended by losing his speech had his education been continued by signs, but in whom, on the contrary, speech had continued to improve even after considerable cessation of use, which had altered it greatly, and whose education finally could be completed by lip-reading simply. His own statement was: "All I know is, that M. Houdin has taught me to read from the lips, and that I *see* the words instead of *hearing* them."

Communication between the Endo- and Peri-lymphatic Cavities of the Labyrinth and Extra-labyrinthine Intra-cranial Cavities. Weber-Liel: *Virchow's Archiv*, Bd. 77, 1879.—The uncertainty existing in regard to the communications of the two aqueducts of the labyrinth led Weber-Liel to attempt the solution of the question by what he calls the method by aspiration, as well as the old method by injection, and he seems to have met with perfect success in demonstrating that the aquæductus vestibuli is an endo-lymphatic passage in direct and free communication with a sac lying beneath the dura mater on the posterior aspect of the petrous bone, and that the aquæductus cochleæ is a peri-lymphatic passage in free communication with the arachnoid cavity.

The sac on the posterior aspect of the petrous bone, saccus intra-duralis or endo-lymphaticus, is of connective tissue, and enclosed in the tissue of the dura mater: it is from 12 to 18 mm. long, and from 5 to 9 mm. broad in its normal condition, but is much diminished by pathological changes in the tissues of the dura mater. In sixty preparations it was found in every one, and may be regarded, therefore, as normal. On opening it the interior was lined with flat epithelium, but the question of whether it is in reality a serous sac remains to be settled. From this sac a membranous tube leads directly to the vestibule.

To demonstrate that this tube communicated with the endo-lymphatic cavities of the labyrinth, Weber-Liel opened the membranous superior semicircular canal, attached a glass tube to it, and connected this with an aspirator. The saccus intra-duralis was now laid open and filled with "Beale's blue," and suction exerted by the aspirator. The different steps of the operation, with the necessary cautions, are given in full. It was found that, by this

method, both the saccules of the labyrinth, all the membranous canals and the ductus cochlearis, were filled with the coloring-matter. The very free communication between the saccus intra-duralis and the endo-lymphatic cavities is also shown by the simple experiment of opening the superior semicircular canal so that the endo-lymph is exposed to view, and then pressing or using suction upon the sac, when the endo-lymph will be forced up through the opening in the canal, or drawn back out of sight, showing both that the communication is very free, and also that during life any pressure or relaxation in the walls of the sac would influence the tension of the labyrinth itself. On the edges of this sac runs the vena aquæductus vestibuli, and the walls of the sac are surrounded by a net-work of vessels.

To determine the connection of the perilymphatic cavities of the labyrinth, two methods were used: injection into the arachnoid cavity, and aspiration from that cavity. By the former method the injected fluid entered the scala tympani of the cochlea, and also exuded through the perforated membrane of the fenestra rotunda; but, as some of the fluid escaped between the dura and pia mater, it was uncertain whether it had entered the cochlea from the arachnoid cavity, and aspiration was then used, as in the previous experiments. The whole anterior part of the preparation was immersed in the coloring-matter, and suction on the opened semicircular canal exerted, with the result of depositing the coloring-matter throughout the peri-lymphatic spaces of the labyrinth, but without coloring the porus acusticus internus, thus proving that the connection could not be that canal. The same experiment was tried by first filling the entrance of the aquæductus cochleæ with the blue, and here also the peri-lymphatic spaces only were filled with the coloring-matter. The freedom of the communication through the cochlear aqueduct was also shown by filling its orifice with fluid, and then, by condensing and rarefying the air of the meatus, this fluid could be drawn inward or pressed outward.

These experiments of Weber-Liel show, then, that the aquæductus vestibuli is a passage communicating and retaining the equilibrium between the endo lymphatic cavities of the labyrinth and a sac situated within the dura mater, while the aquæductus cochleæ is a passage communicating and retaining the equilibrium between the peri-lymphatic cavities of the labyrinth and the sub-arachnoid cavity. The peculiar sense of pressure in the head (*Eingenommenheit*) experienced with many affections of the ear, he would in some cases explain by the assumption that the labyrinthine fluids are forced by pressure through these passages into the cranial cavity, and thus exert pressure upon the brain; and the aural symptoms accompanying some diseases within the cranium he would explain in the opposite way, these passages allowing the fluid to be forced from the arachnoid cavity into the labyrinth. The whole series of experiments and their results are extremely interesting.

On the Chorda Tympani Nerve. Horatio R. Bigelow: *Archives of Medicine*, June, 1879.—The author presents the result of an anatomical and physiological investigation of the chorda tympani nerve in rabbits and dogs, instituted during the spring and summer of 1875. He is led to take issue with the views entertained by Prof. Sappey ("Traité d'auatomie descriptive") respecting the course and function of this nerve. He says: "To me there seems to be no doubt that the special sensory function of the facial filaments is derived from the nerve-cells in the intumescentia gangliformis found upon the nerve of Wrisberg in the aquæductus Fallopii. The chorda tympani sends branches to the lingual just after becoming joined to it in the common sheath between the pterygoid muscles. It is so well-nigh impossible to separate these connecting filaments, and so closely opposed to each other are the two trunks, that I am perfectly aware of the unsatisfactory nature of the dissections; but yet, by means of the glass, I was able to identify so many branches of the chorda tympaui passing to the lingual, and so satisfactorily, for a considerable distance, demonstrated the integrity of each nerve, that I feel convinced that at no very distant day it will be proven conclusively that these nerves are not joined 'fibril to fibril,' but that they pass together in one sheath, the lingual receiving branches from the chorda tympani, which, in turn, is made sensory through *the ganglion upon the nerve of Wrisberg*."

Effects upon Secretion and Circulation produced by Faradization of the Nerves traversing the Tympanic Cavity. By A. Vulpian: *Académie des Sciences*, August 4, 1879 (see *Gazette Méd. de Paris*, August 30, 1879).—Heidenhain demonstrated that the excito-secretory nerve elements destined for the parotid gland come from Jacobson's branch, in accordance with the researches of Loeb in 1869. It is possible—not without some difficulty, however—in dissecting the glosso-pharyngeal nerve in the dog, as far as the base of the skull, to reach Jacobson's nerve and subject it to faradic currents. This experiment of Heidenhain has been repeated by Vulpian, and the latter states that he has seen, while the nerve is under the influence of faradization, an abundant flow of saliva from the parotid gland. He then goes on to say that, as is well known, Jacobson's branch enters the tympanum and one of its six filaments; the deep and external petrosal nerve joins the lesser superficial petrosal nerve, then passes to the auriculo-temporal nerve, which conveys it to the parotid gland; so that in this way the secretory nerve of the parotid gland, during part of its course, is in the tympanic cavity. On the other hand, the chorda tympani also passes through the same cavity.

It would therefore seem possible to electrify, at the same moment in the tympanic cavity, both the chorda tympani, *i. e.*, the excito-secretory nerve of the submaxillary gland and of the sublingual gland, and the branch of Jacobson, or the deep external petrosal nerve, *i. e.*, the excito-secretory nerve of the parotid gland. And this Vulpian confirmed by experiments on dogs, cura-

rized and kept alive by artificial respiration. There is also observed, very often, a certain degree of increase in the flow of tears on the same side. This increased activity of the secretion of the parotid gland and of the submaxillary may be maintained for a long time by this form of faradization, *i. e.*, by an induced and interrupted current.

This form of faradization also brings about very marked vaso-dilatatory phenomena. Leaving out of consideration those manifested in the salivary glands, M. Vulpian describes specially those seen in the buccal cavity. After faradizing the tympanum for fifteen to twenty seconds, by means of a current of moderate intensity, there will be observed an intense congestion of the entire half of the tongue and of the buccal floor on the corresponding side. The mucous membrane of the tongue and buccal surface becomes deep red, the visible vessels are dilated, and the temperature of the entire congested region is elevated.

M. Vulpian was then curious to know what would be the effect of faradizing the branch of Jacobson either at the base of the skull or in the tympanic cavity, on the circulation in the mucous membrane of the buccal cavity. It was shown that the passage of induced currents, interrupted, through Jacobson's nerve, at the point where it is separated from the glosso-pharyngeal, excites a slight redness of the mucous membrane of the lips—especially of the lower one—of the mucous membrane of the cheek, the gums of the buccal floor and of the half of the tongue, all on the side where the faradization occurs. This redness is very visible if both sides are compared, and at the same time slight augmentation of heat is observed in the congested parts. It must be remarked that it is not easy to escape electrization of the superior cervical ganglion at the same time that the glosso-pharyngeal and Jacobson's nerve are electrified; and recognizing this, M. Vulpian proposes, for the sake of accuracy, to excise this ganglion before the experiment in his next series.

Faradization of Jacobson's nerve at the base of the skull did not appear to M. Vulpian to excite the least congestion of the skin of the lips. If, however, the interior of the tympanic cavity is electrified by means of induced currents, the effects are very pronounced. After faradization here for twenty to thirty seconds, during which time the edge of the lower lip may be seen distinctly to blush, the interior of the buccal cavity shows an intense redness on the internal surface of the lips, cheeks, gums, on the side experimented upon; the corresponding half of the tongue and of the buccal floor are extremely congested; the congestion extends to the epiglottis, from the tip of the tongue; the palate and the velum palati on the entire half of the same side are reddened. The mucous fold extending from the upper dental arch to the lower dental arch is often the most congested. The redness of the palate, of the velum palati, and of the tongue, stop almost exactly in the median line, while the congestion in the mucous membrane of the upper lip

sometimes passes that line and extends a little way over the other side. The conjunctiva in the eye on the same side is always redder than that of its fellow: sometimes the difference is great. The skin of the cheek, of the lips, and of the nose may also be congested; but this is much rarer and less marked than the phenomena presented in the buccal mucous membrane. There are also produced a slight congestion of the gray substance of the brain, and a slight dilatation of the vessels of the pia mater covering it.

M. Vulpian then asks the question: "Are these different effects of vascular dilatation to be attributed to centrifugal excitation of true vaso-dilatatory fibres produced by the faradic currents?" In answer to this he says: "It seems to me incontestable that some of these effects are due to excitation of true vaso-dilatatory fibres, and it is to such excitation that the redness observed on the anterior half of the tongue and on the buccal floor must be attributed. This congestion is without doubt due to the electrization of the chorda tympani."

But the congestion of the tongue behind the caliciform papillæ can hardly be attributed to the electrization of the centrifugal vessel-dilating fibres in Jacobson's nerve, since experiment has shown that the vessel-dilating fibres of that part of the tongue are derived from the peripheric part of the glosso-pharyngeal nerve. It is also questioned, by the experimenter, whether the redness of the mucous membrane of the cheeks, gums, palate, and conjunctiva, is produced by direct or reflex vessel-dilating action.

On the various Seats of Mucous Patches, but especially the Mucous Patches of the Auditory Canal. Dr. A. Deprès: *Annales des maladies d'oreille, etc.*, Dec. 31, 1878.—Mucous patches, as is well known, may be found wherever there is skin or mucous membrane. During an experience of six years in the Hôpital de Lourcine, the writer observed five cases of mucous patches and one soft chancre in the auditory canal. He doubts not that he would have found more had he searched for them. Those observed were only discovered because the patients complained either of pain in the ear or deafness. All of the plaques were of the vegetant form. In one case they extended throughout the entire length of the canal and onto the drum-head. The ordinary seat of these plaques is the lower wall of the meatus.

In one case the vegetations extended down both auditory canals. The patient, a female, thirty years old, had syphilis and mucous patches on the vulva and tonsils; her hearing was only slightly affected. This was the only case in which both ears were affected. The discharge from the plaques was slight, and at the outer part of the canals grayish crusts formed.

When there was but one mucous patch of small dimensions, cauterization with a saturated solution of chloride of zinc was sufficient to effect a cure in fifteen days. from two to four applications being necessary. The case with both ears affected required treatment for six weeks. The writer expresses an

opinion that mucous patches of the auditory canal are usually found in those who have been affected by a *previous aural discharge.* The cases reported were observed among 1,200 syphilitic patients, among whom more than 980 had mucous patches at the time they came under observation. Mucous patches of the auricle have also been observed by the writer two or three times at the perforation for the ear-ring in the lobule.

A Case of Ménière's Disease. Dr. Giovanni Longhi: *Revista de Medicina y Cirugía Prácticas*, Madrid, Jan. 7, 1879.—The patient, a woman forty years of age, robust and of good constitution, had always menstruated well, and had given birth to fourteen children, nine of whom were then living, the others having died from convulsions and other diseases during infancy.

Her only infirmities had been a gastritis and some slight fugitive nervous symptoms in childhood. During her pregnancies she suffered frequently from attacks of vertigo, which were relieved by bleeding.

A year previously, in consequence of the death of a child, she was much prostrated, with frequent nausea, and in addition a sensation of heat in the head, considerable flushing of the face, severe vertigo, and subjective noises, resembling whistling, the falling of rain, and the ringing of bells. Swelling of the face, pain limited to the left temporal region and the cheek of the same side, neuralgia of the left ear and of affected teeth; prostration, and even delirium also, sometimes characterized these attacks, which appeared two or three times daily, lasted but a short time, and were much worse in the morning than at night, or *vice versâ.* To these symptoms was at times added an abundant salivation—especially at night.

In this condition the patient applied for relief in July of last year; it was found that the vertigo was increased or brought on by pressure upon the nape of the neck and vertex of the head, which were sensitive to touch, and that the resonance of her own voice, external noises, and also the sound of her own steps in walking, increased the subjective noises in both ears. The patient felt as if she were rising from the earth, as if flying, and that her head was falling backward; at other times as if she were falling toward the left side, on which occasions she found it necesary to seize upon the nearest stationary object in order to support herself from falling. These symptoms were increased by moving. When she lay in a horizontal position some of these symptoms disappeared, but she felt as if the whole room were whirling about her, or as if it were about to sink into the earth, and she was then obliged to change her position.

If she closed the eyes and remained quiet the symptoms diminished, to increase when the eyes were reopened. Very intense or penetrating sounds increased the disturbance of equilibrium, and for this reason, when she went into very crowded places, as for instance in church or in the street, she suffered from a dread of a sensation of suffocation or increased vertigo. On examina-

tion of the fauces, Eustachian tubes, and membrana tympani, there was found no pronounced disease—merely a catarrhal trouble of the middle ear, with slight diminution of hearing.

The case therefore presented in the main the train of symptoms classed as Meniere's disease, the predisposing causes seeming to have been the frequent confinements and finally the suffering at the death of a child.

The treatment consisted in the internal administration of quinine, Valsalvian inflation several times daily, and application of tincture of iodine to the mastoid region.

Six months later the peculiar symptoms had disappeared and the hearing had improved.

FOUR CASES OF INTRACRANIAL DISEASE, CAUSED BY CHRONIC SUPPURATION OF THE MIDDLE EAR. CHARLES J. KIPP: *Archives of Otology*, July, 1879.—In these cases the author desires to show that recovery from intracranial disease, supervening in chronic suppuration of the middle ear, is not so unusual as is commonly supposed, and he urges that in the treatment of grave aural diseases with cerebral symptoms the use of the ophthalmoscope is of great service as an aid in diagnosis. Dr. K. frequently examines the eyes of aural patients who have fever, severe headache, vertigo, nausea, vomiting, etc., and he believes the practice should be more general. With the exception of these frequent inspections of the eyes of the four interesting cases reported, there is nothing unusual in their management. In one of the cases of chronic purulent inflammation of the middle ear that resulted fatally, there was an autopsy which showed the existence of an abscess in the right middle lobe of the brain, and thromboses of the right lateral sinus. There was also caries of the mastoid cells, and double optic neuritis. "The dura mater over the tegmen tympani et antri mastoidei was of a light leaden color, but not thickened or ulcerated. There was no pus between the dura and the bone." The drum membrane had two perforations, the position of the ossicles was normal, but their normal action had been interfered with by accumulations in the tympanum. No caries of the tympanic walls was discovered.

A NEW TEST FOR SIMULATED ONE-SIDED DEAFNESS. DAVID COGGIN: *Archives of Otology*, July, 1879.—The test, applied to a person claiming to be deaf in the left ear, consisted in plugging the right tube of a Camman's stethoscope, and placing *that* tube in the patient's right (good) ear, while the other free tube was in the left (deaf) ear. When the patient had thus put on the stethoscope, it was found that he could hear words whispered and spoken in the thoracic cup which was used as a mouth-piece, thus proving the man to be a malingerer.

The idea is ingenious, but one would be disinclined to risk a decision on the

use of the apparatus described. The experiment, being simple, can be tried by any one, when it will be observed that sound is conveyed through the wooden plug used to close the tube.

Note on the Treatment of Acute Suppurative Inflammation of the Middle Ear. Edward S. Ely: *Archives of Otology*, July, 1879.—Dr. Ely advocates the self-limitation of this class of aural disease, and recommends that they should usually be watched for a few days before any decided treatment is employed; several cases are reported that seem to give force to such a view of the matter. The author of the paper thinks that such pains have been taken to lead physicians and laymen to regard acute suppuration of the middle ear as important and requiring prompt and efficient treatment, that they now are inclined to hold exaggerated ideas as to the means to be employed for their cure. He thinks that, notwithstanding the efforts which have been made to bring these patients under treatment, the majority of them continue to be neglected by themselves and by their family physicians.

The Use of Mineral Waters in the Treatment of Diseases of the Ear. Dr. Ladreit de Lacharrière: *Annales des maladies de l'oreille, etc.*, July, 1879.—Dr. Lacharrière opens his very interesting paper with the statement that no organ is more subject than the ear to chronic diseases and to the influence of diatheses. Scrofula, gout, rheumatism, herpes, and syphilis have so much influence on the development of aural diseases, that whenever an aural disease continues for a long time it is necessary to seek for the predominant diathesis in the patient. In such cases, medicines directed toward the general cause have wonderfully good results; and, among these remedies, none are more potent than mineral waters. Among their good effects are to be counted the social life and distractions of the springs, and they, at the same time, withdraw the patient for a time from the social or vital conditions where the germs of his disease have been developed. It is not always easy to determine exactly the nature of the diathesis; but it is well known that otorrhœa may be of a scrofulous, catarrhal, herpetic, or syphilitic origin, and, of course, a different treatment would be demanded in each instance.

Before speaking of the action of baths in all of the above-mentioned diatheses, the author wishes to give a few cautions about the hydropathic treatment in both its forms of fresh and salt water. It may be said that, in general, the treatment of aural diseases should be free from everything which could congest the deaf organs. Cold water will infallibly produce this result whenever the *reaction of the skin does not considerably exceed the contraction which the cutaneous vessels undergo.* If this reaction is simply equal to the contraction, it is insufficient to prevent the reflux of blood to the deeper parts of the body. In those affected with diseases of the labyrinth, it will be observed that tinnitus aurium, already so annoying, becomes worse, and in those affected with catar-

rhal disease, there is great danger of acute inflammations. It would seem that the action of salt on the skin would favor this much-desired reaction, and this, in fact, will be the case if the bath is a short one. In some instances reaction is complete before the individual has had time to leave the water, and in such cases there is no need of fear; but in most cases this reaction is slow and insufficient.

Dr. Lacharrière dreads, therefore, the action of cold water and of sea-baths in diseases of the ear, unless these conditions are absolutely fulfilled. When recourse is had to such treatment, it should be in the form of short douches, followed immediately by friction with a glove of horse-hair, or, at least, with a piece of coarse flannel.

But all these apprehensions of danger vanish when the baths are taken in warm mineral waters. These offer an incomparable aud powerful form of medication, the only demand being to make an intelligent choice after correctly determining the indications which lead to a preference of one over another.

Sulphur waters.—Sulphur waters may be divided, in the present consideration, into strong and weak, the principal ones of the first kind being those of Barèges, Bagnères de Luchon, Cauterets, Aix les Bains, while the weaker ones are found in Saint-Sauveur, les Eaux-Bonnes, Enghien, Pierrefonds. These, of course, are those best known and most accessible to the French; but such a list may be of use to the American physician as a guide to the kind of water to be used in certain cases of aural disease.

Thus, the waters of Barèges are specially beneficial to the osseous system, and are, therefore, to be administered in cases of disease of the periosteum, either of the auditory canal or the tympanum. If a scrofulous otorrhœa has not invaded the osseous system, the other sulphurous warm baths may be used.

Catarrhal diseases of the ear are not the only ones which may be advantageously treated with sulphur waters; but cutaneous diseases of the ear, especially in the lymphatic temperament, may also find relief, especially in the sulphur-soda waters.

Chlorinated arsenical waters.—Diseases of the ear which are markedly influenced by chlorinated arsenical waters are those which manifest themselves in the scrofulous diatheses, and in which the mucous membranes and their glandular structures are chiefly diseased. Herpetic affections developed in similar conditions, those connected with a rheumatismal diathesis, but in nervous subjects liable to fatigue from the excitement attending the sulphurous treatment, are all benefited by waters impregnated with chlorinated soda, but especially by those containing arsenic. The springs offeriug these qualities are La Bourbole, le Mont-Doré et Royat. At Bourbole scrofula of the mucous membranes may be best treated. Here otorrhœa, in those of a lymphatic temperament with glaudular angina, is almost specifically benefited. At Mont-

Doré relief may be found chiefly for catarrhal affections of the ear, developed in the rheumatic, in those affected with catarrhal neuroses, like asthma, hay-fever, persistent coryza, which never fails to invade the Eustachian tube and the middle ear, these leading to perforation of the membrana tympani, otorrhœa, and all varieties of inflammatory diseases of the ear which are not usually distinguished from each other.

The waters of Royat, by their moderate temperature and their incomparable abundance, which allows constant renewal of the baths, are wonderfully advantageous in the treatment of herpetic diseases generally, and of diseases of the ear dependent upon that diathesis.

Waters containing chlorinated soda without arsenic, like those of Luxeuil, the warm bicarbonates like those of Neris and Vichy, render us good service in the treatment of affections of the middle ear dependent on th› gouty diathesis.

Dr. Lacharrière further says: The changes in the ear are, at times, sufficiently marked to permit a recognition of gout before it has expressed itself elsewhere. These are a vascular engorgement of the chain of ossicles which shows itself on a level with the handle of the hammer, while the membrane still preserves its transparence, and shows no trace of tympanic disease. When this engorgement has lasted for some time, the redness disappears, and the handle of the hammer appears embedded in the fibrous tissue which envelops it. It would seem that now all general treatment would be without effect; but, even in this condition, there is a form of hyperæmia of the middle ear which is modified by thermal treatment. This treatment has, in some cases, checked the tinnitus, which was but the expression of the morbid activity of the ear.

Cold bicarbonate springs.—The waters of Vichy and of Vals are of service in herpes of the auditory canal.

Report on the Cases of Ear Disease observed in the University Polyclinic of Berlin. Prof. Dr. Aug. Lucæ: *Archiv für Ohrenheilkunde,* Vol. XIV., Part 2.—A classified report of the diseases found in 2,388 patients, and the results of treatment, is first given; of these 1,013 are reported cured, 525 improved, while the remainder are included under the heads of unimproved, unknown, and still under treatment. The relative value of these statistics for comparison with other similar tables is, as Prof. Lucæ says himself, very uncertain on account of the different use made by various observers of the terms cured, improved, etc., and also on account of a certain lack of great accuracy which must always attend the report of a large polyclinic.

Certain points, however, which he brings out, are of universal interest. Considering the cases of deafness which are unassociated with a solution of continuity in the drum-membrane as the weakest point in an otological diagnosis, he is in the habit of examining such cases by inspection with the mirror,

by the catheter, by determining the hearing-power for whispered words which the patient repeats, and finally by a series of large tuning-forks from G to c^{iv}. The examination of the bone-conduction he considers as untrustworthy, as it is impossible in this way to examine each ear separately. By this method of examination he has found that certain cases, which would be considered from the objective appearances as chronic tympanic catarrh, really showed a marked disease of the inner ear, as was proven by the great difference in the perception of the higher and lower tones.

Of interest is the fact that but three cases of aspergillus were found in this large number of cases, and Lucæ considers that it is a disease rather of the upper than of the lower classes, more often seen in private than in dispensary practice. Three interesting cases of caries of the petrous bone are given: one of which died from thrombosis of the sinus transversus; in one the mastoid was opened, a sequestrum removed, and a facial paralysis which had existed for a long time was completely relieved and the patient made a good recovery; in the third case the cause of the caries was a primary epithelial cancer of the tympanum, which was operated upon by Prof. Bardeleben, all of the morbid growth being removed by the knife, gouge, and fingers; two months after the patient returned with similar growths on the cheek, temple, and mastoid, which connected by fistulæ with the carious petrous bone; the man died three months after from purulent meningitis dependent upon carcinoma of the dura mater.

In regard to the treatment of nerve-deafness, Lucæ has obtained brilliant results in some few cases of pulsating subjective noises, by the use of hydrobromic acid as recommended by Woakes and Henning, 15–20 drops being given three times a day in syrup.

On a Possible Source of Error in the Diagnosis of Fungus in the Ear. E. Cresswell-Baber: *The British Medical Journal*, March 22, 1879. —It was observed that the effluent water, on syringing the ears of some patients, contained dark masses, which, on microscopic examination, were found to contain mycelium and spores of a vegetable fungus. The frequency of this occurrence in cases where the presence of fungus was not suspected, led to the belief that the fungus must be derived from some other source than the ear; and, therefore, the syringes in frequent use were examined, and found to contain adherent masses of matter about the pistons and barrel, which material, when examined by the microscope, was found to contain a quantity of mycelium and spores of a fungus, probably a form of penicillium grown in a liquid. Although the syringes were cleaned as usual, some water nearly always remained in the barrel, which, together with some rancid oil, the wearings of the leather packing, and oxidation of the metal, etc., seemed to afford an opportunity for the growth of fungi. Aspergillus, the fungus usually found in the ear, is easily distinguishable from the variety developed in the syringe; yet it is well to remember that the latter may be a possible source of

error in diagnosis. It is advisable that all syringes employed in syringing the ear should contain no fungi which could by any chance be introduced into the ear.

A Clinical Lecture on Perforating Wounds and Injuries of the Membrana Tympani, with a Case of Fracture of the Handle of the Malleus. Charles S. Turnbull, M.D.: *Philadelphia Medical and Surgical Reporter*, Feb. 22, 1879.—In this paper the author adds one to the few cases as yet reported of fracture of the manubrium mallei, the reported cases cited by the author being six in number. (Ménière, Gazette médicale, Paris, No. 50, 1856; Toynbee, Catalogue of Preparations, p. 68, No. 630; Politzer, Beleuchtungsbilder des Trommelfells, Wien, 1869; Hyrtl, in a prairie-dog, Wiener medicinische Wochenschrift, 1862, No. 11; Weir, Transactions American Otological Society, 1870; Hinton, The Questions of Aural Surgery.) In the present case, two weeks before the patient applied for treatment, a pen-holder had been driven into the right auditory canal, causing dizziness and slight pain, with an insignificant hemorrhage. During the day the patient, a teamster, nineteen years of age, followed his usual avocation without inconvenience, but after retiring at night suffered from severe pain and a hissing tinnitus; hot fomentations gave little or no relief. On the following morning a neighboring apothecary "kindly advised and more kindly instilled" a strong solution of nitrate of silver. The pain and tinnitus continued until the evening of the third day, when both diminished with the appearance of a purulent discharge, which continued up to the time of examination, when the auricle and meatus were found swollen and the latter filled with pus; the watch was heard on contact. After syringing and Valsalvian inflation, which latter procedure was ineffectual, the air-douche was used, giving the sharp whistling sound indicative of perforation of the membrana tympani, and causing sharp, lancinating pains and tinnitus. On account of the maceration of the parts, no other evidence of perforation was obtainable. Daily syringing with warm salt-water, Valsalvian inflation, and the wearing of pledgets of absorbent cotton during the day-time, were ordered. At the end of forty-eight hours all symptoms of the acute inflammation, pain and tinnitus had ceased. After this the meatus was thoroughly cleansed, the air-douche used, and the mastoid region painted with tincture of iodine every other day. The hearing steadily improved and the discharge decreased, and at the end of the third week the condition of the membrana tympani could be clearly determined.

In the centre of the membrana tympani was a crescentic opening extending across one-third of the membrane, the flap resulting from the crescent shape, including the lower end of the manubrium mallei, which swung to and fro with the flap on Valsalvian inflation, causing sharp, lancinating pain and accompanied by intermittent roaring tinnitus.

At the end of the fourth week, during which gentle inflation had been

practised to favor the removal of the remaining secretion, the hearing for the watch had risen to fifteen inches and all treatment was suspended, with exception of occasional Valsalvian inflation continued with the view of "preventing adhesion of the fractured malleus and torn membrane to the promontory."

Three months later the membrana tympani presented a normal appearance, with these exceptions: the line of the handle of the malleus could be traced to within a short distance of its end, from which a small fragment, the size of a millet-seed, had been broken. This fragment had become united to the manubrium, with some hyperostosis, but was the width of the bone out of its proper line posteriorly. From the thickened point of union, as well as from the lower end of the fragment, a narrow triangular light reflex extended toward the periphery. On using Siegle's pneumatic speculum the malleus was seen to move outward as a whole.

Objective Sounds from the Ears. Holmes: *The West Chicago Medical Society Proceedings*, March 24th; *The Chicago Medical Journal and Examiner*, May, 1879.—A young lady, aged 17, was delicate, and had suffered from childhood from involuntary spasm of the pharyngeal muscles. The spasms occurred about forty times a minute, and resembled the act of swallowing. Synchronous with each spasm was heard distinctly, eighteen inches from the patient's left ear, a clicking sound; much less distinctly from the right ear. The same sound could be heard from the patient's open mouth, but faintly. Laryngoscopic examination showed a separation of the lips of the Eustachian tubes with each muscular spasm. The throat was normal, but the mouths of the tubes were bathed with muco-purulent secretion. The drum-heads were only slightly altered in appearance. With each spasm there was slight motion of the left membrane. The observer thought these sounds were owing to spasms of the tensor tympani muscle.

Antiseptic Treatment of Certain Diseases of the Ear. Kühn: *Deutsche Medicinische Wochenschrift*, April 12 and 19, 1879.—The methods of treatment described by Kühn are those which have been employed in the Polyclinic at Greifswald during the past two years. In the form of disease known as otitis externa it was assumed that the inflammation and secretion of pus were largely, if not exclusively, due to the presence of infective substances in the external auditory canal. In favor of such a belief Kühn refers to the experiments recently carried out by Dr. Schueller, who demonstrated that an otitis externa may be produced in the rabbit by the simple introduction of a certain amount of the purulent secretion of an otitis externa (from the human subject) into the external auditory canal. "To remove these infective substances it is not sufficient to syringe out the canal from time to time with antiseptic solutions; it is necessary to keep the parts *constantly* under this antisep-

tic influence." To accomplish this, Kühn says that they have been in the habit of carrying out the following mode of treatment: "The meatus is first syringed carefully with a weak lukewarm solution of carbolic acid. When the ear has been thoroughly cleansed in this way, a one per cent. solution of salicylic acid is to be introduced into the canal, drop by drop, until it is quite full. To prevent the escape of this solution, and also to prevent the entrance of such irritative substances as are present in the air, the orifice of the meatus is firmly plugged with cotton-wool. The patient is then instructed to repeat this procedure every day at his own home."

Kühn reports that 123 cases of otitis externa have been treated in this way during the past two years at the Greifswald clinic, 78 of this number being under twenty years of age. In the majority of these cases a diminution in the amount of the purulent discharge was noticed very soon after this mode of treatment had been instituted. The penetrating odor which is so characteristic of these discharges disappeared in the course of a few days. The secretion gradually became more and more serous in character, and finally ceased altogether. The swelling of the walls of the canal diminished *pari passu* with the diminution in the amount of the discharge. In 39 out of the 123 cases, the otitis externa was associated with perforation of the membrana tympani. In these the treatment proved to be equally successful, although a longer period of time was required than in the simple cases of otitis externa. In not a single instance did any unpleasant reaction follow the use of this one per cent. solution.

Finally, this same antiseptic principle was adopted in the treatment of ten cases of caries of the mastoid process, after a communication with the outer air had been established through the skin, either by natural processes or by an incision. In all of these cases the healing process was completed within a comparatively short period of time.

A New Method of Opening the Mastoid. Bogroff: *Monatsschrift für Ohrenheilkunde*, Vol. XIII., No. 5.—By the galvano-caustic, the author asserts the firmness of the bone is reduced so that it can be much more easily removed with the gouge. He recommends the alternate use of the galvano-caustic and gouge till the cells are reached. He also proposes the same operation for the removal of exostoses of the meatus. No cases are given.

A New Instrument for the Removal of Adenoid Vegetations from the Naso-pharynx. Delstanche (fils): *Archiv für Ohrenheilkunde*, Vol. XV., p. 1.—This consists of a pair of curved forceps, which are closed by pushing a tube, by means of a lever in the handle, over the arms of the forceps, thereby closing them. The outer half of this tube is a spiral spring which adapts itself to the curve of the forceps, and the handle is bent at a right angle with he tube, so as not to obstruct the view. The principle of the

instrument is the same as that of the forceps which have been in common use in this country for several years for the removal of polypi from the meatus. Delstanche has given it the name of adenotome.

The Scepticism Prevalent regarding the Efficacy of Aural Therapeutics. To what Extent is it justifiable? Samuel Theobald, M.D., Baltimore, Md.—As is well known, the aural specialist has never been able to entirely overcome the deeply grounded prejudice of the laity as regards the necessity of treating diseases of the ear in most instances, but Dr. Theobald strikes at the root of the matter when he meets the opposition which the general practitioner offers in too many instances.

Dr. Theobald's paper discusses the prevalent belief amongst medical men that accuracy of diagnosis in aural affections is unattainable; that danger attends the checking of aural discharges; and that they believe a larger proportion of the causes of deafness which come under their observation to be of nervous origin than they are warranted in doing, and the groundlessness of the belief that when the drum-head has been perforated or broken in any manner the ear is henceforth, as an organ of hearing, of but little, if any, value.

Although this theme is one the aurist has most dwelt upon since the infancy of Otology, it is by no means so threadbare that it needs be to abandoned, for there is less cause for professional indifference to this subject now than formerly, when all aural affections were classified as deafness. The wide circulation of this paper could but be attended by good results.

Glass Bead in the Ear. Voltolini: *Monatsschrift für Ohrenheilkunde*, Aug., 1879.—A method for the removal of foreign bodies, especially adapted to those of a great specific gravity, which prevents their being easily washed out with the syringe, is renewed by Voltolini, having been already described by him in 1864. As the upper wall of the meatus forms a very obtuse angle with the drum-membrane (145°), while the lower wall forms a very acute angle, Voltolini suggests reversing the head, in order that the foreign body may roll along the upper wall as along an inclined plane. With the present case, the child was laid upon a table, with the head hanging backward over the edge as far as possible. The auricle was then drawn toward the vertex of the skull, the ear syringed, and the bead readily removed, the syringe setting it in motion, when it rolled along the drum-membrane to the meatus, and then along this into the concha. In the use of this method, it should be borne in mind that the auricle must be drawn toward the vertex, or in the direction, when the head is erect, upward and backward.

On the Washing out of the Tympanic Cavity and its Recesses. Arthur Hartmann: *Deutsche medicinische Wochenschrift*, No. 44, 1879.—The

instrument employed by Dr. Hartmann for this purpose consists of a silver tube, eight centrimetres long and two millimetres in diameter. [The tube represented in the woodcut which accompanies the original article, measures only one millimetre in diameter, which is probably the correct measurement.] The end which is to be introduced into the middle ear is bent at a right angle, the shorter arm not exceeding one millimetre in length. The other end of the tube is also bent at an angle of about 120 degrees, but in the reverse direction from that of the middle-ear end. This longer bend has a bulbous enlargement, to which a piece of rubber-tubing may be fitted, in order to connect the silver tube with a suitable syringe. Dr. H. lays stress upon the necessity of employing for this latter purpose tubing which is very light and thin, as otherwise it will be found difficult to manipulate the canula in the meatus and middle-ear. The speculum and forehead reflector must be used in introducing the instrument, and, after the latter has been placed in proper position with the right hand, it should be held quietly in its place with the left hand, which should at the same time rest against the patient's head. The right hand is then free to manipulate the syringe.

The author refers to the fact that in these manipulations great differences in the sensibility of the membrana tympani and walls of the middle ear will be encountered in different individuals. In some there is complete anæsthesia of the parts, while in others a slight touch causes discomfort or pain. At first only a stream of feeble force must be introduced into the middle ear; but if neither headache, faintness, nor dizziness is produced thereby, we may gradually increase the force. Only in rare cases, according to the author's experience, were the patients unable to bear a current of considerable force.

With regard to the indications for the washing out of the middle ear with the instrument under consideration, Hartmann says that he has practised this procedure in the following three classes of cases:

1. In all those cases of chronic purulent inflammation of the middle ear in which we have reason to believe that the ordinary method of syringing the ear fails to remove all the products of the secretions which accumulate in the remoter recesses of the tympanum or in the antrum.

2. In cases of former or still active purulent inflammation of the middle ear, in which the development of fresh inflammatory manifestations, or of headache, a feeling of pressure within the head, or dizziness, leads us to suspect that the tympanic cavity or some of the accessory spaces, have become filled with the products of the secretions.

3. In cases of caries of the external auditory canal, the canula being introduced into the fistulous opening.

The author remarks that he has often been astonished at the amount of material brought away by the stream of warm water when introduced in this manner into the middle ear. In a large percentage of the cases a permanent

arrest of the otorrhœa seems to have been effected by this plan of treatment. In other cases it was found necessary to repeat the operation at stated periods, as fresh accumulations formed during the intervals.

An Instrument for removing Fluids from the Tympanum. Schalle (Hamburg): *Archives of Otology*, October, 1879.—This instrument is designated by the author as an exudation-sucker, and consists of a fine silver canula that is, when used, to be introduced under illumination; and through a speculum, into the tympanum after paracentesis has been performed. The canula is 4 cm. long, and 1.4–2.5 mm. thick, with a funnel-shaped extremity of 4 mm. circumference. It is bent at the larger extremity at almost a right angle, and at this larger end it is connected by rubber tubing to a siphon-shaped glass tube of convenient length, at the other extremity of which is again attached tubing long enough to be used for suction by taking the free end into the mouth.

In cases where the fluid lies on the floor of the tympanum or adheres to its walls, the author recommends that a canula be used with an extremity bent about 3 mm. near the point. The author does not use the instrument in cases where the fluid is thin enough to be driven out by the air-douche or by Valsalva's method. This apparatus can also be used for injecting fluids into the tympanum by attaching a syringe to the glass tube by means of rubber tubing.

A Case of Closure of the Auditóry Meatus, and Loss of Hearing by the Formation of Exostoses, complicated with Acute Perforative Inflammation of the Middle Ear, with repeatedly recurring Granulations—Restoration by the Use of Laminaria Rods and the Galvano-Cautery. S. Moos: *Archives of Otology*, October, 1879.—A case where there had never been any disease of the ear, but where total deafness occurred on the right side within two days. Examination showed that the deafness was owing to a globular exostosis springing from the posterior wall of the external auditory meatus and completely filling its whole calibre. From this growth a smaller projecting one is described, the covering skin of which was of a dull white color, while the cutaneous envelope of the large growth was red and thickened. A third exostosis is mentioned as existing, and almost closing the canal where it approaches the one to which allusion was first made. The author describes this case as one of *acute closure* of the meatus, due to the presence of bony excrescences. There was neither pain nor discharge, but a feeling of fulness in the right ear.

An expectant treatment for four days, of instillations of a weak solution of zinc. sulph., was followed by pain, and was omitted. Three days later, the surface of the swollen parts showed slight purulent discharge. Owing to an increase of deafness at this time, the author concluded to try the application of laminaria, and a rod 2 mm. thick was introduced into the small fissure that

existed between the growth and the wall of the meatus. The meatus was now plugged with wadding to retain the laminaria in position. Its presence for twenty-four hours occasioned violent and constant pains until it was removed: it had swollen to 5 mm., not in circumference, but along its orifice. A probe could now be passed further inward than before, but not entirely through. The day after the removal of the dilating tent there was violent purulent discharge, and a laminaria rod, 1 mm., was introduced; the pains were violent at evening, but diminished by the next morning, and the laminaria was allowed to remain another day, although causing continued pain. Two days later it was swollen to 5 mm. in circumference. The fissure was now found to be enlarged, and the surface of the posterior exostosis was suffused with blood. Purulent discharge and occasional pains were noted for the next five days (two weeks after the patient was first seen), when the surface of the exostosis was cauterized with lapis infernalis, causing pain which extended into the concha; an abundant secretion remained, but otherwise no alteration of condition. On the day following the cauterization a laminaria rod, 1 mm. thick, was introduced and permitted to remain for twenty-eight hours, causing incessant and violent pains during the whole period. The rod was swollen to 5 mm. in circumference. The surface of both exostoses was excessively granulated, and the fissure choked by the granulations, which grew luxuriantly for three days, when they were removed with a snare, causing excessive bleeding. The next day the patient was free from pain, and the granulations, which had begun to sprout, were again cauterized. Early the following morning he had excruciating pains in the bottom of the ear, spreading over the temple, forehead, and occiput; there was no abatement of these symptoms until the next day, when a discharge was established and the pain diminished. There was afterward a perforation sound heard when Politzer's method was practised. For more than six weeks after this the granulations were abundant, and were treated by the galvano-cautery at intervals; the anterior exostosis was then found to be absent, and the ear was quite dry. Hearing was improved, and the author states that the patient was wholly free from every annoyance.

The author concludes that the closure of the meatus in this case was due to an inflammatory swelling of the soft parts, the granulations were due to the laminaria and cauterizations with the lapis infernalis. The acute perforative inflammation of the middle ear was regarded as secondary, and due to propagation from the external auditory meatus.

Four Cases of Severe Disease of the Mastoid Process. Moos: *Archives of Otology*, October, 1879.—These cases are reported chiefly on account of their symptoms, and of their diagnostic value as regards those diseases of the mastoid process in which the osseous part of the auditory meatus is

mostly involved. In two of the cases the anterior portion only of the mastoid process was involved by the disease.

In the first case reported, that of a boy aged 12, the mastoid apparently became involved about nine months after the invasion of purulent inflammation of the middle ear; but the case was not seen by the reporter until two years after the first attack. There was then inflammation of the mastoid, which was red, swollen, and tender on pressure, with fluctuation. The auricle stood out at almost a right angle to the surface of the skull. There was a fistulous opening about the middle of the swelling, but no connection could be established between it and some roughened patches of bone felt on the posterior wall of the meatus, at the junction of the cartilaginous and bony portions.

The membrana tympani could not be seen, on account of the polypoid tissue springing from the diseased wall of the meatus. The necessity for Wilde's incision was urged; but the patient's mother withheld her consent for nearly three weeks, at the end of which time the incision was made under chloroform, and the granulations were removed with a snare. The bone, which was found to be very rotten, was easily penetrated by a knife, and after the evacuation of a large amount of thick. offensive pus, water was injected from the opening in the mastoid to the external auditory meatus.

For a month afterward the treatment consisted in a preservation of the communication between the two openings, and the administration of sustaining food. The general health improved; but the luxuriant granulations which sprang up in the meatus closed the communication which had been established. Six weeks after the operation above mentioned the granulations were again removed, and a month later the patient was sent home. A few months subsequently the granulations returned, and finally a sequestrum was removed from the posterior wall of the meatus. The patient now recovered, with the exception of a discharge from the middle ear, the bony openings having closed, leaving two bulging hyperostotic elevations. The membrana tympani was now seen, and found to be retracted, the lower and posterior quadrant and the anvil absent, the stirup remaining *in situ.*

In this case the maintenance of the passage of the wound in the bone was regarded as of great importance in the treatment.

The second case was one where purulent inflammation had existed in the right ear in youth. At the age of ten years a swelling appeared behind the right ear, and, after causing violent pains, opened, but closed again after a short time. Discharge from the ear continued for a time, leaving the patient deaf in the right ear.

This patient, when he came under observation, was 18 years old, and had ten days previously, following a cold, violent pains in the right ear and in the whole right half of the head. A scar about 2 cms. long was found on

the sunken mastoid process. The external auditory meatus was filled with a pale red fluctuating growth, which was attached to its posterior superior walls.

An abscess was diagnosed in the anterior and outer segment of the mastoid process, which was opened by a free incision, liberating a large amount of pus, without, however, giving any relief. The patient was not seen again for ten days, when he was brought to the clinic in a wagon. He was now much worse; had had chills and terrible pains over the left half of the cranium, extending to the neck, the spinal column, and the extremities. He had also been at times delirious. Several large polypi were found filling the meatus at the point where the abscess had been opened.

Regarding the symptoms as indicating the presence of meningitis, complicated perhaps with pyæmia, the patient was placed in charge of the medical clinique. He now had an offensive discharge from the external auditory meatus, and laid with his eyes shut, his mouth open, groaning, and answering only slowly and with difficulty; was aroused with difficulty, and was feverish; pulse strong, but not frequent. He had slight stiffness in the neck.

The patient remained under indoor treatment for nearly two months, during which time an abscess formed behind the right ear, and was opened, evacuating pus, pulpy, reddish brown masses, and a small sequestrum from the mastoid cells. The opening communicated with the external auditory meatus. Granular tissue was removed from the external auditory meatus afterward. During the treatment he was given salicylate of soda, quinine, chloral hydrate, etc., and ice-bags were for a time applied continually to the head. When now seen by Prof. Moos, some three months subsequent to his first visit, an immovable sequestrum remained in the bottom of the meatus, covered with granulations. The tympanic membrane was still invisible, and both openings in the mastoid process communicated. The patient felt quite comfortable; the secretion was scant and without odor. He was discharged from the hospital at his own request. The author thinks, if the patient had returned, his treatment of the sequestrum would have been similar to that in the former case.

In the third case, that of a man aged 29, there had also been a discharge from the right ear in youth, which only ceased when he was 17. Three months before he was seen, pain came on in the right ear, spreading gradually outward and laterally until it was of a most serious character. Finally, violent headache set in and spread out over the right half of the cranium, accompanied by repeated vomiting, loss of appetite, obstinate constipation, thirst, and fever. The outer region of the right mastoid process looked normal, and was not sensitive to pressure or percussion. Granulations were present in the external auditory meatus, and at a point where there was evidently a communication with the mastoid cells an apparently polypoid growth was seen. At this place an incision into the posterior swelling was easily made, the knife

passing forward in an oblique direction from 3 to 4 cms. A large amount of offensive pus escaped; also partly cholesteatomatous and partly more purulent masses; and the wall of the abscess fell forward in the form of a large polypoid swelling. Relief was decided, but it was not complete at once. Notwithstanding treatment, the pains in the ear and the head, as well as the constipation and vomiting, lasted for some days, a decided improvement not taking place for a week.

"After the incision had been made, onion-like scales of epithelium, overlying one another, partly yellow or yellowish white, and partly shiny, escaped daily from the cavity of the abscess, which, however, did not grow smaller." A large portion of the polypoid and prolapsed wall of the abscess was now removed with the scissors, when large quantities of the cholesteatomatous mass were removed. On retraction of the wall of the polypoid abscess, the cavity was found to consist of the interspace belonging in common to the external auditory meatus and the anterior segment of the mastoid cells. Immediate relief was now obtained; but for three weeks these cholesteatomatous masses evacuated themselves daily, or were removed by the forceps. "About this time, diffuse, connected, and partially uneven hyperostoses showed themselves on the lower wall of the external auditory meatus, while the granulated portions everywhere diminished at a later stage. A perfect cure soon followed.

In this case there was, as a result of the abnormal action, destruction of the cells of the whole anterior segment of the mastoid process, and of the neighboring wall of the bony external auditory meatus in front, with the exception of a small portion united with the cartilaginous wall. The posterior half of the membrana tympani was also destroyed. It was the belief of the author that the labyrinth had not been injured. It is a noteworthy fact that the outer surface of the mastoid portion was without swelling and quite free, on the whole, from alterations, the carious action being confined to the outer and middle segment of the petrous bone. In these cases, the author says, we should always make an incision.

The fourth case, which proved fatal, had a resemblance to the three previously reported.

Swellings and enlargements of the posterior wall of the external auditory meatus are not very uncommon, and, although they are not to be regarded as of absolute value in a diagnostic point of view, as regards the character of the mastoid disease, yet the therapeutical indications are of great importance.

Pulsating Tumors of the Tympanic Cavity. Dr. Gellé: *La Tribune Médicale*, November 16, 1879.—After alluding to the cases of this disease described by Drs. Robert F. Weir and A. H. Buck, M. Gellé expresses himself in favor of incising the drum-head in order to obtain access to the tumors. Then

he proposes a process of slow destruction of the growth by means of cauterizations with phenic acid, or, still better, with perchloride of iron, conveyed several days in succession to the growth, through an incision in the membrana tympani. M. Gellé then says that one is led to think that it might be feared that such growths were in the tympanic cavity, in all cases, when the patient complains of painful pulsations in the ear more or less synchronous with the pulsations of the heart, with deafness and vertigo, especially when at the same time an opacity of the membrana tympani interferes with a direct determination of the process, and renders a visual diagnosis impossible. He then gives other guides for such a case as the deformity and immobility of the membrane, which show a previous pathological process, and he also says that the presence of granulations in the neighborhood of the faucial opening of the Eustachian tube adds another probability to the existence of the above-named process in the drum-cavity.

Furthermore, the endotoscopic or manometric examination, or, still better, the employment of an apparatus for registering, can demonstrate the presence of a pulsatile tumor, by showing the pulsations of the membrana tympani not in a state of active inflammation. In such a case, a successful inflation of the tympanic cavity, by carrying the membrana tympani outward, moves it from the tumor, and the pulsations and rhythmic oscillations of the needle in the above-named register cease for the time-being. This, of course, would show that the tumor is beyond the membrana tympani. If the pulsations can be arrested by compression of the carotid, the vascular nature of the lesion within the drum is further proven.

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NOTES.

For the woodcut illustrating the communication of Mr. Edison, the Journal is indebted to the courtesy of the publishers of the *Scientific American*.

Attention is called to the circular issued by the publisher of the *Index Medicus*. The expense attending the publication of this valuable index being necessarily very great, further subscriptions are requested. The discontinance of the *Index Medicus* would be a serious loss to the profession at large.

Subscribers to the Journal of Otology having duplicate copies of No. 1, Vol. I., will confer a favor by returning the same to Messrs. Wm. Wood & Co., 27 Great Jones Street, New York.

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AMERICAN

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ORIGINAL COMMUNICATIONS.

ON THE OCCURRENCE OF EXOSTOSES WITHIN THE EXTERNAL AUDITORY CANAL IN PREHISTORIC MAN.[1]

By CLARENCE J. BLAKE, M.D.,

BOSTON.

I.

Although the occurrence of these peculiar bony growths as an accompaniment or result of diseases of the external auditory canal and middle ear is well recognized by aural surgeons of the present day, and is treated of in the several text-books on aural surgery, from Toynbee onward, comparatively little mention of the subject is made, for the reason that, practically considered, except in cases where they are excessively developed, they are of but little importance to the surgeon.

This fact will probably account for the small percentage of such cases recorded in the reports of aural clinics, a review of such reports published in Great Britain, on the Continent, and in America giving, on an average, five cases of exostoses recorded in

[1] This paper was read by title at the annual meeting of the British Medical Association, Aug. 5, 1879. It is intended to be the first of a series of similar observations.

each one thousand cases of aural disease. It is readily understandable that in the tabulation of hospital cases the smaller exostoses covered by the integument lining the canal, and calling forth, by their presence, no decided symptoms, should either escape notice or especial mention, a record being made only of those cases in which the growths especially attracted attention, or in which they were so excessive or so far served to complicate some other existing disease of the ear as to call for surgical interference.

Particular attention has, on the other hand, been called to the fact of the existence of aural exostoses in crania, especially of American origin; and since these growths might be supposed to have some connection with the possible habits or race-character of the peoples in whom they are found, the subject has received a fair share of attention from craniologists. The opportunity afforded for the detection of these growths and the determination of their exact location and true character, after the removal of the overlying soft parts, will serve to account for the greater proportion of these cases observed in the examination of crania from various sources and recorded by various writers, especially within the last fifteen years. Even under these circumstances, the recorded cases of aural exostoses are very few in number, and since these growths have been observed particularly in the crania of American prehistoric races, it is to be hoped that the opportunity afforded by the large collections of such crania now in progress in this country will be availed of for further investigation of this interesting subject.

It is partly with the hope of furthering this interest that the examination of the crania of the mound-builders of Tennessee, which forms the basis of this paper, has been undertaken; and, so far as I am aware, no similar examination of the crania of this race has as yet been made. The crania in question form a part of the large collection of the Peabody Museum of Archæology and Ethnology in Cambridge, and it is proposed to extend the same examination to the crania of other American races in this collection. To the courtesy of Prof. F. W. Putnam, curator of the museum, I am indebted for this opportunity, and also for valuable advice and personal assistance in making the examination and tabulating its results.

Attention was first especially drawn to the presence of exostoses in the external auditory canal in American crania, in 1864, by Prof. Seligmann, who found these growths in five out of six "Titicaca," "Huanka," and "Aymara" crania, and who inclined to the opinion, as quoted by Prof. Welcker in a paper on this subject published in the *Archiv für Ohrenheilkunde* of the same year, that there might be a connection between the occurrence of these growths and the artificial elongation of the crania in question. This view is combated by Prof. Welcker, who found exostoses in two out of nine crania of Marquesas Islanders, forwarded to him from the collection of Dr. J. Barnard Davis, and also in the skull of a Fox Indian (Mississippi), No. 229 in the Heidelberg collection.

This view, as well as that according to which the peculiar narrowing of the external auditory meatus observable in many Peruvian crania, is the result of the artificial elongation of the head, is also negatived by Prof. Wm. Turner in a recent publication, in which are described exostoses occurring in an artificially deformed Peruvian skull from Pisagua closely resembling the distorted Aymara cranium, also from Pisagua, figured by Dr. Davis in his "Thesaurus Craniorum," and also in the adult skull of a flat-head Chenook Indian, found in the Natural History collection of the Edinburgh Museum of Science and Art.

In concluding his paper, Prof. Turner says: "As these two crania, as well as those examined by Prof. Seligmann, had been much altered in shape by artificial compression, the question naturally arises if the growth of the exostoses had been induced by the pressure to which the bones had been subjected in infancy. There is nothing in the appearance of these two skulls to bear out this supposition. Notwithstanding the deformity of the vault of the cranium and a somewhat backward inclination of the squamous temporal, the zygoma and the parts around the meatus have preserved their normal form. Again, although Prof. Seligmann found exostoses in as many as five out of six artificially deformed crania which came under his notice, I have only seen the above two specimens, while seventeen other artificially deformed crania of North and South American Indians have been examined. At the same time, I should say that in at least three of these skulls the auditory

meatus (though without any exostoses) was modified in shape from what one usually sees, for, instead of being almost circular at its orifice, it was antero-posteriorly compressed, so that the vertical diameter was markedly greater than the antero-posterior. I am not, however, prepared to ascribe this modification in the form of the orifice of the meatus to the artificial compression, for I have observed in several specimens of Peruvian skulls, which were not artificially deformed, a similar alteration in the form of the external meatus. There would thus appear to be a tendency on the part of the aboriginal inhabitants of the American continent to possess modifications in the configuration of the external auditory passage."

The opinion here expressed by Prof. Turner led me to add to my examination of the mound-builder crania for exostoses, the measurement of the diameters of the external auditory meatus, and the results obtained, together with more superficial observations made some time previously in a large number of Peruvian crania, fully confirm his opinion. Should similar investigation in other races show as fixed a type of proportion, the dimensions of the orifice of the external auditory canal may advisedly, it would seem to me, be added to the list of acknowledged cranial measurements.

My own attention was first drawn to this subject, in 1874, by Prof. Jeffries Wyman, who submitted for examination six out of three hundred and thirty-four Peruvian crania which had recently come into his possession, in which six crania there existed exostoses in the external auditory canals. A peculiarity of the growths in these six cases was that they were almost uniformly situated at the entrance of the canal, and upon the anterior superior or posterior inferior wall. From the results obtained in the present examination of the mound-builder crania, I am led to believe that the more careful examination of these same Peruvian crania, now in the Peabody Museum, which I hope to make in continuation of this paper, will reveal other cases of exostoses less prominently noticeable. In the six cases in question, the orifice of the meatus, aside from any alteration in shape in consequence of the exostoses, was much narrowed, and in the majority of the three hundred and

thirty-four crania the vertical diameter of the meatus much exceeded the antero-posterior diameter.

To furnish the basis for the present paper, of the crania taken from the stone graves—mound-builders—of the Cumberland Valley, Tennessee, obtained for the museum, as the result of the explorations of Prof. Putnam, one hundred and ninety-five were examined, and the measurements of the external auditory meatus made as follows: of the vertical diameter, from the centre of the arch of the superior wall to the inside of the lip of the inferior wall of the canal; of the antero-posterior diameter, from the inside of the outermost lip of the anterior wall to the opposite point on the posterior or mastoid wall.

Both canals were measured and the average of the two taken for record, except when one canal was abnormally large. In imperfect crania, where the bone had broken away, or had been injured by rodents, these measurements were necessarily omitted or modified; the great care which had been taken in the preservation of these crania, however, rendered this necessary only in five cases, and of the one hundred and ninety crania measured, the average diameters were found to be: vertical diameter, 10.1 millimetres; antero-posterior diameter, 6.3 millimetres.

In thirty-six of the one hundred and ninety-five crania, about 18 per cent., exostoses were found in one or both canals, and the average diameters of the canals, without reference to the narrowing effected by the exostoses, was found, in thirty of the thirty-six, to be: vertical diameter, 10.3 millimetres; antero-posterior diameter, 5.7 millimetres, showing a more decided narrowing of the canal in the cases in which exostoses existed, this being in part accounted for by a general thickening of the anterior and posterior walls of the canal.

For purposes of comparison, measurements were also made on this occasion of the canals in fifty Californian crania, taken from graves in the Islands off Santa Barbara, and the average diameters were found to be: vertical diameter, 11.1 millimetres; antero-posterior diameter, 8.61 millimetres. Of one hundred and eight Californian crania, superficially examined—that is, without exact measurement of the canals—five were found to possess exostoses in one

or both canals, and in three of the five a corresponding narrowing of the canal, without reference to the exostoses, was observable.

On reviewing the tabular statement herewith presented, compiled from the more exact examination of the thirty-six mound-builder crania in which exostoses were found, it appears—

1. That exostoses occurred in both canals in twelve out of the thirty-six crania, and of the remainder, in the right canal in nine and in the left canal in fifteen crania.

2. That of all the exostoses detected, fifty-four in number (counting the triple exostosis found in cranium No. 18,503 as one), forty-two occurred on the posterior and twelve on the anterior wall of the canal.

3. That making the division into "rounded" and "flattened," to distinguish the two forms principally assumed by these growths, twelve belonged to the former and forty-two to the latter class.

The flattened exostoses occurred principally upon the posterior wall of the canal, varied from three to six millimetres in width at the base, and extended inward along the wall of the canal parallel to the long axis of the passage, while the rounded exostoses had their origin, as a rule, from the anterior superior or posterior inferior lip of the anterior inferior wall of the canal. It is this latter form of exostosis in this location, as figured by Welcker in the paper cited, which has principally attracted the attention of craniologists, as may well be the case, since it is the rounded exostosis which is more prominent and which usually attains the greatest size, even completely blocking, in some instances, the entrance of the canal.

The consideration of the etiology of these curious growths with a view to any light which may be thereby thrown upon the habits or development of the extinct races in which they are found, is a most interesting one, but is unfortunately of little service.

Otological authorities of to-day differ as to the possible predisposing causes of such growths, and in the majority of cases coming under clinical observation are enabled to refer them frequently to some source of irritation in an existing disease of the external or middle ear. Toynbee mentions the possibility of their occurring usually in persons of a gouty or rheumatic habit, and Gruber finds a possible explanation in reference to hereditary or acquired syphilis. Neither

of these possible explanations is, however, fully supported by the general facts accompanying the occurrence of these growths, and in regard to a connection with specific disease I may say that especial pains were taken to examine these mound-builder crania for evidences of syphilitic disease, either in the form of the more minute cranial lesions or as evidenced by the peculiar "natiform" skull described by M. Parrot in the London *Lancet* of May, 1879. In this connection the examination of the California crania (in which the exostoses occurred in 5 per cent. as compared with 18 per cent. in the mound-builder crania) is also of interest, for no race probably ever had a better opportunity for developing syphilis than had the California Indians after their contact with the Spaniards.

So far as local irritation may have had to do with the causation of these growths, the fact, already mentioned, that the majority of them occurred upon the posterior wall of the canal, the wall most exposed to violence from without, may possibly be of importance, but there is nothing, so far as I am aware, in the various remains taken from the stone graves pointing to any peculiar custom or ornamentation, which might have had an influence in predisposing to or causing bony growths in the external auditory canal, and moreover, though the occurrence of these exostoses may be apparently more common in New World races, this can by no means be taken as an established fact while comparative data are so meagre as at present. Certainly, according to Welcker and Turner, the growth of these exostoses cannot be regarded as a race-characteristic peculiar to American crania; were this at all possible the comparison of the mound-builder crania with the Peruvian brachycephalic crania in regard to their occurrence would be especially interesting.

That the habits of a people should have an influence on the uniform causation of such growths is hardly possible though certainly conceivable. The discovery of exostoses in the external auditory canals of crania of Hawaiian Islanders, and again in crania from the Bay of Chacota, Peru, by Prof. Wyman, suggested to him the possible influence of the aquatic habits of the people, and this suggestion gave an added interest to the examination of the crania of the mound-builder, a people living far inland, in whom, as has been shown, they equally pertain.

There is one other possible influence which may have a bearing upon the occurrence of these growths, and which is at least worthy of consideration in any future investigations which may be made, and that is, hereditary tendency. Of the more marked cases—that is, cases exhibiting excessive growth without evidence of other aural lesion—I have found, in aural practice, that the majority have occurred in certain families, in the male members of successive generations, the most marked instance being in the three successive generations of one family in which there is no tendency either to gouty or rheumatic disease.

The mound-builders, as we know, made their settlements in the fertile river-bottoms, clustering together in more or less distinct communities, and of thirty cases of exostoses found in these crania ten came from one distinct locality and six from another.

The facts presented are at least suggestive, and if any reliance can be placed upon them it will be interesting in future investigations to compare, so far as is possible, the carved shells or totems found in the mounds from which the crania were taken.

With the large additions which are now being made with each succeeding year to collections of American crania, the pursuance of examinations as to the occurrence of aural exostoses and the tabulation of dimensions of the external auditory meatus, in addition to other cranial measurements, promises to afford material of interest at least, if not of positive value.

In the following tabular statement the numbers given are those marking each skull in the Peabody Museum collection. For purposes of comparison, note is also made of the cranial type.

TABULAR STATEMENT.

MOUND-BUILDER CRANIA.

18,248. *Brachycephalic.* R. two exostoses, one on the anterior superior wall, 4 mm. wide, 6 mm. long, the other on the posterior inferior wall, in the form of an elongated ridge, extending inward from the outer lip of the canal and 3 mm. in diameter. L. one rounded exostosis on the anterior superior wall 2 mm. in diameter.

18,251. *Brachycephalic.* L. on the posterior wall a flattened exostosis, 3 mm. wide, 6 mm. long.

18,402. *Brachycephalic.* L. on the posterior wall a flattened exostosis, 4 mm. wide, and 7 mm. long.

18,277. *Brachycephalic.* R. on the posterior wall a rounded exostosis, 5 mm. in diameter. L. a similar growth in a corresponding position, 4 mm. in diameter.

18,280. *Brachycephalic.* R. on the posterior wall a rounded exostosis, 4 mm. in diameter, and on the anterior superior wall a large flattened exostosis, hardly sufficiently marked in outline to distinguish it as a distinct growth. L. on the anterior wall two rounded exostoses, impinging and together 3 mm. in diameter.

18,503. *Brachycephalic.* L. on the posterior wall a triple flattened exostosis, extending inward from the outer lip to a depth of 9 mm.

17,314. *Brachycephalic.* R. on both anterior and posterior walls flattened exostoses, 6 mm. and 7 mm. in diameter. L. corresponding exostoses, respectively 5 mm. and 6 mm. in diameter.

18 274. *Brachycephalic.* R. on the posterior wall a flattened exostosis, 3 mm. wide and 8 mm. long, the antero-posterior diameter of the canal being only 4 mm. L. antero-posterior diameter of canal 3 mm.; no exostoses.

17,279. *Brachycephalic.* L. two exostoses, nearly touching across the canal, that on the anterior wall 2 mm. and that on the posterior wall 3 mm. in diameter. R. flattened exostosis on posterior wall, 4 mm. in diameter; the anterior wall much thickened.

17,275. *Brachycephalic.* L. long, flattened exostosis on the posterior wall, 3 mm. in diameter.

14,256. *Brachycephalic.* R. on the posterior wall a flattened exostosis, 4 mm. wide and 7 mm. long.

18,599. *Orthocephalic.* L. on the posterior wall a flattened exostosis, 4 mm. wide and 7 mm. long, also a small flattened exostosis on the anterior wall.

18,620. *Dolichocephalic.* Broad flattened exostoses on both posterior walls.

16,006. *Brachycephalic.* Flattened exostoses on both posterior walls.

14,273. *Brachycephalic.* R. broad, flattened exostosis on posterior wall.

15,[illegible]18. *Brachycephalic.* Broad, flattened exostoses on both posterior walls.

15,910. *Brachycephalic.* R. on the posterior wall a rounded exostosis, 4 × 9 mm. in diameter.

15,997. ——— L. on the posterior wall a rounded exostosis, 4 × 8 mm. in diameter.

16,003. *Brachycephalic.* R. on the posterior wall a rounded exostosis, 2 mm. in diameter.

15,827. *Brachycephalic.* R. the canal nearly closed by a large rounded exostosis, 9 mm. in diameter, springing from the posterior wall. L. a small exostosis on the posterior wall.

14,090. *Brachycephalic.* R. on the posterior wall a rounded exostosis, 3 mm. in diameter, also a small exostosis of the same form on the anterior superior wall. L. on the posterior wall a rounded exostosis, 4 mm. in diameter.

15,213. *Brachycephalic.* L. on the posterior wall a small rounded exostosis.

15,998. *Brachycephalic.* R. on the posterior wall a group of long exostoses, nearly closing the canal, which had an antero-posterior diameter of 6 mm.

14,006. *Brachycephalic.* L. on the posterior wall a flattened exostosis, 4 mm. in diameter. R. a corresponding exostosis, 5 mm. in diameter.

15,904. ——— L. on the posterior wall a flattened exostosis, 3.5 mm. in diameter.

15,913. ——— L. on the posterior wall a flattened exostosis, 4 mm. in diameter.

15,829. *Brachycephalic.* R. on the posterior wall a flattened exostosis, 4.5 mm. in diameter.

15,219. *Brachycephalic.* L. on both anterior and posterior walls flattened exostoses, 3 mm. in diameter at the base and nearly touching across the canal.

15,839. *Brachycephalic.* L. on the posterior wall a rounded exostosis, 2 mm. in diameter.

14,096. *Brachycephalic.* R. on the posterior wall a flattened exostosis, 5 mm. in diameter, and on the anterior wall, more deeply seated, two exostoses, respectively 3 mm. and 4 mm. in diameter. L. on the posterior wall a flattened exostosis, 4 mm. in diameter.

15,215. ——— L. on the anterior and posterior limits of the inferior wall two small exostoses, a third small exostosis, rounded, on the anterior superior wall. R. a broad exostosis, irregular in shape, and including in its base nearly the whole of the posterior wall.

12,018. ——— (Lebanon group). L. large exostosis, 6 mm. in diameter, springing by a broad base from the posterior wall at the entrance of the canal, projecting upward and forward, and touching the superior anterior lip which was somewhat thickened.

11,325. ——— (Lebanon group). L. on the posterior wall, just within the outer lip, a peculiar nipple-shaped exostosis, 3 mm. in diameter.

12,310. ——— (Lebanon group). R. on the posterior wall a long, flattened exostosis.

CALIFORNIAN CRANIA.

9,166. *Orthocephalic.* R. small, flattened exostoses, on the posterior wall, 3 mm. in diameter, and on the anterior wall, 2 mm. in diameter.

9,156. ——— L. on the posterior wall, flattened exostosis, 4.5 mm. in diameter. R. a similar exostosis, 1 mm. in diameter.

13,234. *Orthocephalic.* On both posterior walls small, flattened exostoses.

13,233. *Dolichocephalic.* L. on the posterior inferior wall a group of three small, rounded exostoses, averaging 1 mm. in diameter, one also on the anterior wall near the tympanic ring, 1 mm. in diameter. R. a small, flattened exostosis, 2 mm. in diameter on the posterior wall, and a corresponding growth on the anterior wall near the outer lip.

9,181. *Orthocephalic.* L. on the anterior wall two small, flattened exostoses, a similar growth on the anterior superior wall averaging 2 mm. in diameter.

9,189. *Brachycephalic.* L. on the posterior wall, near the outer lip, a small nipple-shaped exostosis, 1 mm. in diameter.

PHLEBITIS OF THE MASTOID EMISSARY VEIN, FROM PHLEBITIS OF THE LATERAL SINUS.—DEATH FROM PYÆMIA.—AUTOPSY.

By J. ORNE GREEN, M.D.,

BOSTON.

In the number of this journal for July, 1879, I reported three cases, characterized by early and prominent symptoms in the tissues of the neck (tenderness, induration, and swelling), which, taken together with the later symptoms, led to the diagnosis of phlebitis and thrombosis of the emissary mastoid veins, secondary to the same disease in the lateral sinuses, of which the emissary veins are branches. All of the cases were fatal, but in none of them was it possible to confirm the diagnosis, as autopsies were not obtained. The point of great practical interest in these cases was the early appearance of the symptoms in the tissues of the neck, which, if the diagnosis of inflammation of the emissary vein was correct, obliged us to give a very doubtful prognosis, even before any symptoms in the general system had shown themselves. The histories of all of the cases pointed to inflammation of the tympanum as the origin of the fatal complications.

Since reporting these cases I have had under my care another one, in which the diagnosis was confirmed by autopsy.

Nellie T., aged nineteen, single, entered the Boston City Hospital on Nov. 19, 1879. As long as she could remember there had been a slight discharge from the right ear, which still continued; formerly there had been also discharge from the left ear, but this had been healed for several years. There had been no pain or other symptoms than the discharge from the right ear till three weeks before entrance, when she began to have severe pain in the right ear. Eight days before admission she had attacks of vomiting, always preceded by vertigo, and this had recurred several

times. Four days before, in addition to the severe pain in the ear itself, a severe "throbbing" pain in the top of the head, with more or less pain over the right side of the scalp, set in, and continued constantly.

Physical examination of the heart, lungs, and organs of the abdomen showed them all healthy.

Nov. 20th. Chill last night, but slept pretty well. Another chill this afternoon; much pain in the top of the head.

℞. Chloral hydrate................gr. xv.
Morphiæ sulphatis..............gr. $\frac{1}{6}$. M. At 6 P.M.

Nov. 21st. At the request of Dr. C. E. Stedman, I saw her with him, and found the following condition: a profuse, offensive discharge from the right meatus; more or less destruction of the right drum-membrane, but the meatus and deeper parts were so much swollen that the exact condition could not be determined. There was great tenderness in the bone of the right mastoid upon pressure, and very slight œdema of the soft parts over the bone; there was also great tenderness and slight œdema along the edge of the skull for three inches backwards from the mastoid, and for a short distance down the neck; no fluctuation anywhere. The most tender point was behind the mastoid, over the exit of the emissary vein through the skull. The only complaint was of pain in the ear and at the top of the head; this was evidently severe. The strength was good and sensorium unaffected; the pulse was 100, and the temperature 101° in the axilla; watch r. $\frac{0}{96}$; no subjective noises.

The diagnosis of chronic purulent inflammation of the tympanum, with probable caries, and with undoubted inflammation of the mastoid, was made. At the same time it was stated that probably inflammation of the lateral sinus, and of the mastoid emissary vein had already occurred as a secondary affection.

Perforation of the mastoid cells was advised, and, being agreed to by the patient, was done under ether. An incision one and a half inches in length was made half an inch posterior to and parallel with the auricle down to the bone. No pus was found, and the bone was perfectly sound. With a triangular borer three-sixteenths of an inch in diameter the cells were then easily per-

forated, the external mastoid wall being very thin. No pus was evacuated, but, on passing in a bent probe, the thin partition-walls between the cells were found to be so softened that they were felt to break down under the probe, and a small amount of grumous material was syringed out. Water passed with perfect freedom into the wound and out of the meatus. She was ordered a warm carbolized douche through the mastoid and tympanum, twice a day, and opiates as before, if necessary, for the pain.

Nov. 22d. There was much less pain in the head.

Nov. 23d. Had slept well, except a chill at 2.30 A.M. of short duration. Still less pain in the head, and the œdema and tenderness over and behind the mastoid were very much diminished. Diet entirely of milk, of which she takes five pints daily.

Nov. 27th. The record states that the patient occasionally has slight chills; the headache and pain in the ear are entirely gone; the œdema has almost disappeared, and there is only a trace of tenderness over the emissary vein. She reports herself as "feeling well," and talks about how soon she can go home. On account of the very high temperature she was ordered—

Sponge baths every two hours.

℞. Quiniæ sulphatis......... gr. ij., every four hours,

but as no effect from these could be seen at the end of forty-eight hours, they were omitted, and she was given

Champagne............................Oi. daily.

Dec. 2d. The tissues just in front of the sterno-cleido-mastoid muscle, which had been tender for three days, became painful, slightly swollen, and more dense than natural. The tenderness extended down to the clavicle. The only complaint was of the neck. There was no other pain anywhere. Slight chills recurred frequently.

Dec. 4th. There was a broad band of induration, without well-defined edges, running down the right side of the neck, from the mastoid to the clavicle, for which a poultice was applied.

Dec. 5th. This induration of the neck was less in its upper portion, but just above the clavicle it was broader, and extended slightly onto the chest, and the next day there was a circumscribed swelling, with redness and great tenderness, over the middle of

the clavicle. Although the chills recurred at frequent intervals, the strength and general condition were as good as ten days before, and she always replied that she "felt very well."

Dec. 7th. There was slight delirium for the first time.

Dec. 8th. The respiration was short and rapid, 40 per minute, and she was much weaker, with slight delirium and rapid loss of strength. She died on Dec. 9th, twenty days after entering the hospital.

The autopsy was made by Dr. E. G. Cutter, pathologist of the hospital, seven hours after death.

The body was well nourished, but rather cyanotic. There was a distinct swelling over the clavicle, which, on section, was found to contain bloody pus under the skin and among the muscles. On dissecting up the periosteum of the skull, pus exuded in considerable quantity from the foramen of the right emissary vein, and the tissues at the base of the skull were infiltrated with pus. The sulcus of the right lateral sinus was denuded and slightly carious on its surface, the carious bone extending forward to the cavernous sinus. In the tympanic roof was a small carious opening, one-eighth of an inch in diameter, communicating with the tympanum.

The right lateral sinus contained a softened thrombus, and its walls were purulent. The dura mater beneath this sinus was elevated by a thin bloody pus. The dura and pia mater were both slightly discolored for a small space over the carious spot in the tympanic roof. The amount of blood in the pia mater was about normal. There was no disease of the great centres.

The acini of the liver were indistinct, and the organ was flabby, soft, and in a state of parenchymatous degeneration. In the left lung were several localized engorgements, and in the posterior part of the middle lobe of the right lung was an embolic abscess, while the lower lobe of the same lung was somewhat solidified.

Both kidneys were large, pale, and yellowish, with the tubules extremely cloudy. The spleen was large and flabby; its pulp was hyperplastic, and showed numerous small hemorrhages. The stomach and intestines were normal.

The accompanying table of the temperature, taken at intervals of two hours throughout nearly the whole course of the disease,

and of the pulse taken twice daily, gives the only important features of the case not mentioned in the history.

Before entering the hospital, the only symptoms were chronic otorrhœa of many years' duration, and recent pain in the ear, with vertigo, and vomiting. After entrance the subjective symptoms were pain in the ear, mastoid, and at the top of the head, with irregularly recurring chills, and a very variable temperature, as can be seen in the table; the objective symptoms were great tenderness of the mastoid bone, and tenderness, with œdematous swelling, along the edge of the base of the skull, but without fluctuation; later in the disease there was swelling and induration down the neck to the clavicle.

The case offers a number of points of special interest, the most prominent of which was the œdematous swelling and extreme tenderness over the foramen of the emissary vein, which led to the suspicion, stated at the time to a number of the medical class, of already existing phlebitis of the lateral sinus. The two chills on the preceding day would have led one to fear an infection of the general system, but without the external manifestation of the œdema and sensitiveness it would have been impossible to have defined and localized it, and, moreover, the chills could have readily been referred to the acute inflammation of the mastoid cells, which certainly existed, as shown by the sensitiveness of the mastoid bone. I advised the operation of opening the mastoid cells without any expectation of influencing the phlebitis, if it already existed, but considering it indicated by the tenderness of the bone itself, and by the severe pain in the ear, and giving the patient the benefit of the doubt in regard to the phlebitis. The relief from the operation was most marked, for not only was the pain in the ear, mastoid, and head completely relieved for the rest of her life, but there was a decided diminution in the swelling and tenderness along the base of the skull.

The recurring chills, with the very sudden rises and falls of the temperature, showed that, however well the local ear disease was progressing, pyæmia was running its course. The chills and

variable temperature were absolutely the only symptoms of the general disease for seventeen days; there was apparently during that time no loss of strength or appetite, not the slightest delirium, and the patient always reported that she "felt well." Thirty-six hours before death respiration became very rapid, from the emboli in the lungs, and mild delirium set in.

The table is interesting as showing the very sudden rises and falls of temperature, and the extreme variations characteristic of pyæmia.

Several points of the autopsy are worthy of attention. The removal of the periosteum from the external surface of the skull, which necessarily cut across the emissary mastoid vein, showed large quantities of pus exuding from the venous foramen; the muscular tissues in the neighborhood were infiltrated with pus, but there was no collection at any one point forming an abscess. The induration along the sterno-mastoid muscle was apparently due to a similar infiltration by gravitation, although this was not determined accurately by dissection on account of the impossibility of so doing without defacing the body. I had supposed during life that the symptoms in the neck were due to phlebitis of the internal jugular vein by extension from the lateral sinus, but examination of the sinuses did not confirm this, the phlebitis ceasing before it reached the jugular, and no signs of inflammation being visible in that part of the jugular which could be examined from within the skull. The caries in the roof of the tympanum was wholly unconnected with the phlebitis, the dura mater, although slightly discolored over it, being free from all inflammation at that point.

It was impossible to remove the petrous bone for dissection, but it was very evident that there was inflammation and caries within the mastoid cells and tympanum, that this inflammation had excited the phlebitis of the lateral sinus, probably through the minute foramina communicating between the mastoid cells and the sulcus of the sinus. At the time of the operation there was inflammation both of the mastoid and of the sinus, the former of which was relieved by the operation, but the latter ran its course, and ended in pyæmia.

In some particulars this case differs very decidedly from the three previously reported. In all of those cases the external manifestation of the internal disease consisted of a hard induration of the superficial tissues of the neck, of greater or less extent, which, in one case, was incised after it had existed for a considerable time, and the tissues were found to be infiltrated with pus. In this last case there was no such induration, but an inflammatory œdema. In all of the cases there was great tenderness over the affected part. The difference in the cases was probably due to the existence in the previous cases of an early obstruction to the circulation from thrombus, and a slow suppuration in the tissues, while in the last case there was either slight obstruction to the circulation or an early suppuration; in other words, in the three former cases the thrombosis was more prominent than the phlebitis, while in the last case the phlebitis predominated. In the first series of cases the induration existed for a considerable time without any change in the pulse and temperature, or any affection of the general system: in the last case there was no induration around the emissary vein, and the general system was affected almost at the beginning.

	Temp. F.	Pulse.	
Nov. 18, A.M.	100.2		
P.M.	101		
" 19, A.M.	100.7		
P.M.	100.9	100	
" 20, A.M.	99	72	Chill.
P.M.	105.2	118	Chill.
" 21, A.M.	100	80	
P.M.	101	92	Operation.
" 22, A.M.	100	80	
P.M.	101	90	
" 23, A.M.	103.8	98	Chill.
P.M.	101.2	98	
" 24, A.M.	103.8	108	
P.M.	103.2	100	
" 25, 8 A.M. ...	104	112	
9 A.M. ...	102		
10 A.M. ...	104		
2 P.M. ...	103		
4 P.M. ...	99	110	
" 26, 8 A.M. ...	100	100	
10 A.M. ...	100.4		
12 M.	105		

	Temp. F.	Pulse.
Nov. 26, 2 P.M. ...	103	
4 P.M. ...	104	
6 P.M. ...	105	108
8 P.M. ...	104	
" 27, 8 A.M. ...	103.2	120
10 A.M. ...	104	
12 M.	104	
2 P.M. ...	104	
4 P.M. ...	104	
6 P.M. ...	104.6	128
8 P.M. ...	104	
" 28, 8 A.M. ...	101	110
10 A.M. ...	104	
12 M.	104	
2 P.M. ...	106	
4 P.M. ...	105.2	
6 P.M. ...	104.8	120
8 P.M. ...	104	
10 P.M. ...	103	
12 P.M. ...	101	
" 29, 2 A.M. ...	100	
4 A.M. ...	101	

	Temp. F.	Pulse.	
Nov. 29, 6 A.M....	103.2		
8 A.M....	103	120	
10 A.M....	101		
12 M......	103		
2 P.M....	104		
4 P.M....	105		
6 P.M....	104 8	118	
8 P.M....	101		
10 P.M....	·97.8		
12 P.M....	98		
" 30, 2 A.M....	104		
4 A.M....	104		
6 A.M....	105		
8 A.M....	104	118	
10 A.M....	103		
12 M......	101		
2 P.M....	98		Chill.
4 P.M....	104		
6 P.M....	104 6	116	Chill.
8 P.M....	105.6		
10 P.M....	105		
12 P.M....	102		
Dec. 1, 2 A.M....	98		
4 A.M....	98.2		
6 A.M....	100		
8 A.M....	102.3	120	
10 A.M....	105.3		
12 M......	105		
2 P.M....	105.2		
4 P.M...	104		
6 P.M....	101	124	
8 P.M....	100		
10 P.M....	97.4		
12 P.M....	100		
" 2, 2 A.M....	99		
4 A.M....	99		
6 A.M....	99		Chill.
8 A.M....	105	130	
10 A.M....	104		
12 M......	106		
2 P.M....	102 2		
4 P.M....	102.9		
6 P.M....	103	124	
8 P.M...	102		
10 P.M....	102.2		Chill.
12 P.M....	104		
" 3, 2 A.M....	101		
4 A.M....	101.8		
6 A.M....	98		Chill.
8 A.M....	101	112	Chill.
10 A.M....	104		
12 M......	103.9		
2 P.M....	101		
4 P.M....	99.2		
6 P.M....	103.2	112	
8 P.M....	102		
10 P.M....	102.9		

	Temp. F.	Pulse.	
Dec. 3 12 P.M....	100.3		
" 4, 2 A.M....	101.4		
4 A.M....	100		
6 A.M....	100.2		
8 A.M....	98	100	Chill.
10 A.M....	103		
12 M......	105		
2 P.M....	104.2		
4 P.M....	102		Chill.
6 P.M....	102		
8 P.M....			
10 P.M....			
12 M......			
" 5, 3 A.M....	98		
6 A.M....	102		
8 A.M....	101	112	
10 A.M....	105		
12 M.	101		
2 P.M....	101		Chill.
4 P.M....	105		
6 P.M....	104	124	
8 P.M....	102		
10 P.M....			
12 P.M....			
" 6, 4 A.M....	99		Chill.
6 A.M....	102		
8 A.M....	101	120	Chill.
10 A.M....	102.3		
12 M......	102.9		
2 P.M....	100		
4 P.M....	98.1		Chill.
6 P.M....	102.9	120	
8 P.M....	100.8		
" 7, 8 A.M....	104	120	
10 A.M....	101.9		
12 M... ..	98.9		
4 P.M....	98.8		
6 P.M....	102	130	
8 P.M....	106		
10 P.M....	104.9		
12 P.M....	103		
" 8, 2 A.M....	103		
4 A.M....	103.9		
6 A.M....	103		
8 A.M....	103.1	128	
10 A.M....	102.2		
12 M......	105		
2 P.M....	103		
4 P.M....	104.8		
6 P.M....	104	128	
8 P.M....	102.6		
10 P.M....	102		
12 P.M....	102.2		
" 9, 3 A.M....	104		
5 A.M....	104.9		
7 A.M....	102	128	
8 A.M....	103		Death.

CLINICAL OBSERVATIONS.

Reported by E. D. SPEAR., Jr , M.D.
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The records of the following cases were selected from the abundant material afforded by the aural clinic of the Infirmary, with a view of presenting such cases as might prove of interest to the general practitioner, as well as to the aural surgeon.

For the opportunity afforded for presenting them, the writer is indebted to Dr. Henry L. Shaw and Dr. Clarence J. Blake, in whose terms of service the cases occurred.

While it is impossible to submit a detailed account of cases, many of which attended only the out-patient department of the Infirmary, it is hoped that a description of their more noticeable features may render them of sufficient interest, and atone, in a measure, for the want of more accurate delineation.

Case I.—W. W. N., æt. 72, in good general health, applied at the Infirmary, May 24, 1879, for relief from an acute purulent inflammation of the left middle ear. Examination revealed a perforation in the posterior segment of the membrana tympani, copious muco-purulent discharge, and a mucous polypus springing from the inner tympanic wall and extending through the perforation in the membrana tympani. As the patient lived at a distance from the city, and could not be taken into the House, the treatment consisted in daily syringing, the use of astringent instillations at home, and the application of argentic nitrate at the clinic, for the purpose of removing the polypus, and the granulations which were found to spring up abundantly, filling the tympanic cavity and inner end of the canal, and bleeding easily under touch with the probe.

Under this treatment, the case was apparently progressing favorably, when, on Sept.,4th (more than three months after the

first visit) the patient appeared at the Infirmary with marked facial paralysis of the left side; there was also at this time pain in the left ear, which was readily controlled by small doses of morphia. The facial paralysis continued, and persists at the time of writing. In consequence of the paresis of the lids, conjunctivitis, from exposure, supervened but was relieved, after supporting the lower lid, by means of strips of adhesive plaster. Sept. 18th, there was, with an increased swelling of the lining of the canal, an exacerbation of pain, which was relieved by the application of leeches in front of, and behind the auricle.

After the attack, the case progressed favorably, and with the partial subsidence of the swelling, a mass of necrosed bone could be seen and felt at the inner end of the canal. The remaining swelling, the pressure of the granulations, and the locking of the necrosed mass, made it impossible to remove it without undue violence, until Dec. 27th, when it was extracted, together with two smaller fragments.

An examination of the larger piece of bone, 9 mm. long by 6 mm. broad, showed it to consist of a portion of the petrous portion of the temporal bone, including the first and second whorls of the cochlea; the cupola being wanting, and the cavity of the cochlea open throughout nearly its whole length, with necrosed edges.

Following the removal of the bone there were no untoward symptoms; the patient continued in attendance upon the out-patient department; and the granulations, which had been very abundant and increased after the removal of the bone, were kept in abeyance and steadily diminished under the treatment above indicated.

With this exception of improvement, there was no change in the symptoms until nearly two months later, when a second piece of necrosed bone was detected at the inner end of the canal, imbedded in granulations. This was easily removed by careful manipulation with the forceps, and was found to be a second portion of the petrous bone, including a part of the vestibule, and of the superior and horizontal semicircular canals.

During the time in which exfoliation of the last fragment was

occurring, the patient suffered very little from pain. Throughout nine months, while under treatment, he was but once confined at home, though he passed a few days at the Infirmary as a house-patient, while feeling unable to make the more frequent visits which were at one time necessary. At no time were there symptoms calling special attention to the mastoid cells, or evidences of cerebral disturbance. The general health continued good, and there was neither œdema, erythema, nor noticeable tenderness over the mastoid region. It is perhaps needless to say that the hearing was entirely lost at an early stage of the disease.

The case still continues under treatment; the facial paralysis has neither increased nor diminished.

Case II.—J. D., æt. 30, teamster; purulent inflammation of the left middle ear of a long standing. Patient applied for relief at the Infirmary, in August, 1879, giving the following history. On or about the first of the month he was suddenly seized, while at work as usual, with severe pain in the head; this pain was general, not confined to any particular locality, and continued during the day; not so severe, however, as to oblige him to leave his work. On returning home at night he immediately retired, and within an hour the pain became more circumscribed, and, as he expressed it, "in the ear." This pain continued more or less severe for several days, and obliged him to give up work. At the time of his first visit the pain had greatly diminished, and the general condition had somewhat improved; there was, however, a more or less persistent dizziness—a symptom which had appeared early in the attack. Examination showed a perforation of the membrana tympani in the anterior segment, the remaining portion of the drum-membrane being much thickened, and the posterior superior portion especially projecting considerably outward. Through the perforation oozed a slight muco-purulent discharge. There was neither tenderness, redness, nor swelling about the auricle or over the mastoid process; and the only unfavorable symptom, aside from the slight dizziness, was pain, not very severe, however, referred to the frontal and temporal regions; the general condition, appetite, and digestion were fairly good.

The treatment ordered consisted in warm syringing of the ear, astringent instillations, and the administration of tonics—sulphate of quinia, and citrate of iron and quinine—the case remaining under occasional observation. Dec. 2d, four months after the first attack of pain in the ear, the patient, on returning to the clinic, stated that one week previously a swelling had made its appearance upon the neck below the ear, and that the pain, of which he had had but little, and that only occasionally, had become continuous, and had so far increased as to deprive him of sleep for several nights.

In addition to the projection of the posterior superior portion of the membrana tympani, which had increased, there was swelling and redness of the lining of the external auditory canal at the inner end along the superior wall, a general diffused enlargement of the tissues over and around the mastoid process, and intense redness extending from above the centre of the mastoid region downwards over the upper third of the sterno-cleido-mastoid muscle. A distinct sense of fluctuation was conveyed to the fingers over a considerable part of this tumefied region, though more especially over a small circular portion, a centimetre in diameter, just behind the auricle, and on a horizontal line extended backward from the auditory meatus. At this latter point, which also seemed to be the thinnest, a deep vertical incision, one centimetre in length, was made. There was no discharge of pus from this opening; the fluctuation still remained; and a probe passed down to the bone, and beneath the superficial layer of the deep cervical fascia, failed to liberate pus. Poultices were then applied over the mastoid region, and the patient taken into the house. The muco-purulent discharge through the perforation in the membrana tympani still continued. On the following day the probe again failed to reveal any purulent collection, but there was more decided fluctuation at a spot two centimetres behind the first incision. Poultices continued; and on the following day a second incision was made at a point about three centimetres distant from the meatus, and including the spot of greatest fluctuation, but neither pus nor serum followed the withdrawal of the knife; there was, however, considerable relief from pain. The poultices were continued, and pus appeared for

the first time at the point of the second incision on Dec. 7th, six days after the first incision was made.

Dec. 9th, it became necessary to make a third incision just over the tip of the mastoid process, and from this opening flaky pus was evacuated. During the following night there was considerable pain, and on the next day purulent discharge from both openings; a linen tent was inserted in the last opening, as it seemed inclined to close; and this proving insufficient, on the next day the opening was enlarged, the collected pus freely evacuated, a free communication of the opening established, and pressure applied below the mastoid process to prevent burrowing. From this time the patient rapidly improved, and on Dec. 16th, five days later, was in a very comfortable condition. eating and sleeping well, and free from pain—pus discharging freely from both openings. Notes of the day, two weeks later, state that the patient feels quite well; that there is a slight muco-purulent discharge through the perforation of the membrana tympani, which is clearly marked and permits the detection of small granulations in the tympanic cavity; the openings made behind the ear are all closed, with exception of that last made, which exudes laudable pus and is granulating from the bottom. One week later, Jan. 10th, the opening over the tip of the mastoid was entirely closed, the granulations in the tympanic cavity had disappeared, and the patient was discharged.

Case III.—J. R., æt. 30, a robust and healthy man; blacksmith; came under treatment Jan. 8, 1880, for severe purulent inflammation of the right middle ear, giving the following history: At some time in the summer of 1879 he strolled through the woods, endeavoring to study the effects of poison-ivy—rhus toxicodendron—upon his hands. The warmth of the day invited him to a bath in the river near by, and while bathing he felt water enter the right ear. This he tried to remove by thrusting his finger forcibly into the auditory canal. A sensation of discomfort, which he curiously enough attributed to a poisoning from the ivy recently handled, ensued, and after his return home increased to severe pain, which was relieved on the appearance of a discharge from the ear. Eight days later the discharge had ceased and the ear was apparently

healed. There was no further trouble until about one month previous to his appearance at the clinic, when he again had pain in the ear, followed by discharge; this latter symptom, syringing with soap and water and the instillation of some unknown liquid, failed to relieve, and, by the advice of his family physician, poultices of slippery elm and onions were unsparingly applied, the whole side of the head in the region of the ear being kept covered with these applications.

At the time of his appearance at the clinic there was a profuse purulent discharge, the removal of which showed the lower wall of the external auditory canal to be much swollen and congested. This swelling extended inward from a point within the meatus to a depth of about one centimetre, and there was in addition sufficient œdema of the lining of the canal farther inward to prevent an adequate view of the membrana tympani. There was also intense redness with œdema and tenderness over the right side of the neck, extending backwards from the ramus of the jaw, over the mastoid process and downwards toward the sternum. Tenderness was more especially marked over the tip of the mastoid process. The pain which accompanied these conditions was more severe at night; the patient was constipated, and had a temperature, taken in the mouth, of 39° C. (102° F). He was taken into the house, and a laxative and sulphate of quinine .12 grm. (gr. 2) ordered to be given at three and six o'clock in the afternoon; the ear to be frequently cleansed by syringing with warm water, and all poultices and warm applications to be omitted. On the following day the patient was in better condition; the swelling, tenderness, and much of the redness about the ear had disappeared. During the next three days the swelling in the external auditory canal, which it was at first thought might conceal a fragment of necrosed or carious bone, greatly diminished, and a more thorough examination was rendered possible. From the inner end of the elevation pus oozed freely, but careful exploration failed to detect dead bone; there was but little tenderness within the canal, and none over the mastoid, the appetite was good, temperature normal, and there was but little pain at night.

On Jan. 12th, four days after entrance, the favorable progress

of the case was interrupted by a new complication, the first symptom of which was a complaint on the part of the patient of pain and discomfort about the malleoli of each foot; considerable swelling and redness were found in front of each ankle-joint, and a few scattered spots of a red color were found upon the legs. A rheumatic cause being suspected, he was given salicylic acid in borax solution.

On the following day there was an increase of the swelling about the left ankle-joint, and difficulty in walking was experienced on that account. The left wrist was also swollen, but was neither reddened nor painful. By this time there had appeared a well-developed eruption of purpura simplex, the spots varying in size from one millimetre to one centimetre in diameter, and often enclosing punctate hæmorrhages; they were not raised above the skin, and did not disappear on pressure. The greater part of the skin of both lower extremities, extending even half way upwards over the thighs, was covered with these irregularly outlined spots. Citrate of iron and quinia was substituted for the salicylic acid. On the third day after the full appearance of the eruption, spots which had first been noticed began to fade, and but few new spots appeared. On the fourth day, the patient was seen by Dr. J. C. White, of Boston, who confirmed the diagnosis, and suggested the administration of ergot.

Under this treatment the disease rapidly retrograded, and on Jan. 19th, one week from the time of its irruption, all the purpuric spots had disappeared.

During this time the ear had steadily improved, the purulent discharge greatly diminished, the subsidence of the swelling in the canal permitted a more favorable examination and treatment of a few granulations remaining upon the membrana tympani. There was no pain in or around the ear; the hearing, which had been greatly diminished by the previous inflammation of the middle ear, and additionally impaired by the recent trouble, was improving; the general condition of the patient was such as to permit him to return to work, and he was discharged from house-treatment Jan. 29, 1880.

Case IV.—Mrs. H. C., æt. 25, usually strong and healthy, and the mother of three children, was seized, three weeks before her

appearance at the clinic, with a severe pain in the right ear, followed by a profuse purulent discharge. The relief from the pain accompanying the appearance of the discharge led her to defer seeking advice until, following exposure to cold wind, pain recurred, and increased in severity, being referred principally to the mastoid region. Three days later she noticed swelling and redness over the mastoid and pain upon pressure, especially over the mastoid foramen. When she finally applied at the clinic, there was found, perforation of the membrana tympani with profuse mucopurulent discharge, considerable swelling along the posterior wall of the external auditory canal, swelling in the neighborhood of, but less directly over, the mastoid process ; redness and tenderness upon pressure. Ordered, poultices directly over the mastoid, and morphia internally at night. These measures giving but slight relief, the patient was taken into the house on the tenth day after she had first noticed the recurrence of pain in the ear, and a Wilde's incision, two centimetres in length, was made from above downward over the mastoid process and down to the bone. No pus appeared either upon incision or with subsequent poulticing ; the patient was free from pain during the remainder of her stay in the house ; and with exception of an intercurrent diffused inflammation on the anterior wall of the canal, lasting twenty-four hours, made a good and rapid recovery, the primary middle ear trouble yielding readily to the subsequent usual treatment.

Case V.—J. H., æt. 22 ; teamster. One week previously, when descending from the high seat of a furniture-wagon not in motion, he slipped and fell to the ground head foremost, striking forcibly upon his chin at a point a little to the left of the median line ; the consequences of the blow would seem to show that its principal force was received at this point. He at once lost consciousness, and remained senseless for about twenty minutes. Considerable hæmorrhage from the ear immediately occurred, and oozing of blood, gradually diminishing, continued during the twenty-four hours following ; during this time there was steady pain in the ear, and the hearing was apparently destroyed. At the time of examination, eight days later, there were still sufficient marks of the cut upon

the chin to bear evidence as to the direction and severity of the blow; and as further evidence, portions of the bicuspid teeth on both sides were wanting. On the right side, corresponding to the injured ear, the inner edges of the second bicuspids were apparently clipped away, and on the left side the inner edge of the upper bicuspid had suffered a similar mutilation.

The right auditory meatus contained a small blood-clot, on removing which, the anterior inferior osseous wall of the canal, from its outer lip to a depth of about four millimetres, was found to have been driven upward into the lumen of the canal. The edge of the bone, covered by the integument and fresh cicatricial tissue, could be plainly defined projecting into the canal to a distance of about one-half its diameter. Beyond this was a collection of pus and blood, the removal of which greatly improved the hearing and revealed the membrana tympani intact, and without evidence of rupture. No attempt was made to replace the bone, which in the interval between the accident and the examination had become firmly fixed in its new position.

The few following cases, though briefly noted, may be worthy of record in support of the fact, the truth of which cannot be too strongly urged, that foreign bodies in themselves innocuous may be placed and remain comparatively harmless within the external auditory canal, especially if undisturbed, for a considerable length of time.

Case VI.—A girl, æt. 7, placed a piece of slate-pencil, one centimetre (two-fifths of an inch) in length, in the right ear. Its presence caused neither pain nor inconvenience, but later on, having become deaf in that ear, she confessed to her parents, who supposing the presence of the foreign body an adequate cause of the loss of hearing, brought the child to the clinic, ten months after the introduction of the foreign body.

The canal was found to be filled apparently with cerumen, but on touching the mass with a probe the pencil could be plainly felt. By means of syringing it was brought sufficiently without the canal to be seized with the forceps, and easily withdrawn.

It was lying, originally, necessarily lengthwise within the meatus,

its outer extremity at the junction of the osseous and cartilaginous portions of the canal. The membrana tympani was uninjured, and the hearing improved immediately upon removal of the mass.

Case VII.—A boy, æt. 5, had two weeks previously placed a small white bean in the right ear. The parents stated that on the night before his appearance at the clinic the bean had slipped so far outward as to be visible, and that they had awaited this before bringing him for treatment. The bean was situated just beyond the junction of the osseous and cartilaginous portions of the canal, and on one side there was a small space between it and the wall of the canal.

Its removal was easily effected by means of a single syringeful (about two fluid ounces) of water.

Case VIII.—A girl, æt. 3, put a small holly berry into the right ear. The physician who saw her immediately afterward judiciously refrained from instrumental interference, and, failing to remove the foreign body by syringing, sent the child to the Infirmary.

The berry was plainly visible at the inner end of the canal, and was removed with a single syringeful of water.

It has been customary, in keeping the records of cases of foreign bodies in the ear, in the out-patient department of the Infirmary, to note the quantity of water required for the removal of each foreign body, and the results are interesting as evidence of the ease with which the majority of these substances are removed by judicious syringing alone. On the other hand, cases have not infrequently been brought to the clinic in which previous injudicious attempts at removal have resulted in very considerable injury to the ear. Such instances are fortunately apparently diminishing in number, and, during the period of clinical service covered by the observations here reported, no such case was presented.

A CASE OF PURULENT INFLAMMATION OF THE MIDDLE EAR.

By ELIZA M. MOSHER, M.D.,

Medical Officer of the Massachusetts State Reformatory Prison for Women.

That the following case is incomplete in its record is due to the circumstances under which the patient came under observation. Committed to the prison, she was transferred to the hospital department and there remained until the expiration of her term of sentence, when she was discharged and the case terminated, so far as any possibility of record or observation was concerned. Even in its incomplete state the record presents some points of interest.

The woman, A. McC., æt. 35, married, and by occupation a prostitute, was admitted to the prison hospital July 12, 1879, with the following history: No children; husband a man of bad character. She had always been healthy until eleven years ago, when she had enlarged and suppurating cervical glands, but denies having had eruption on the skin, or other symptoms which might indicate a specific lesion. She was treated at a dispensary for five months, and was given "a blue ointment" for external use, and some medicine, which she cannot describe, to take internally. Since that time her general condition has been fairly good, with exception of considerable frontal headache during the last month.

Present condition (on the above date): anæmic, syphilitic cachexia, chancroids on internal aspect of thigh near vulva, appetite poor, digestion impaired, bowels constipated, menstruation regular. Persistent frontal headache, and, in addition, complaint of general "pain in bones." Hearing diminished in the right ear. During the twenty days following, treatment was directed to the improvement of the general condition by means of administration of the iodide of potassium, bromide of potassium, fl. ext. rham. frangulæ, and the touching of the chancroids with the solid stick of nitrate of silver.

At the end of the twelfth day the chancroids had healed, the digestive disturbance had largely disappeared, and the general condition was much improved. The pain in the head continued, however, and by Aug. 2d had increased and became centred in the left ear. During the night the pain in the left ear became intense, but ceased suddenly, and an examination made on the following morning revealed a large perforation of the membrana tympani and a purulent discharge. The ear was ordered to be syringed twice daily, and the Politzer air-douche to be gently used. Iodide of potassium, which had been given in 20 gr. doses thrice daily up to July 31st, and since that date in 10 gr. doses, was discontinued, and sulphate of quinia in 2 gr. doses substituted.

On Aug. 5th there was almost complete paralysis of muscles supplied by left facial nerve; there was difficulty in swallowing, the temperature was 99° F., pulse 72 and weak. The quinia was continued, and beef-tea and milk ordered every two hours alternately.

Aug. 6th.—Tests made with the Faradic current gave no response on the part of the paralyzed muscles. The discharge from the ear continued free and was somewhat offensive, and granulations were observable springing up in the middle ear. The pain in the head returned at night with considerable severity, but is not complained of during the day.

In addition to the syringing a warm solution of sulpho-carbolate of zinc was dropped into the ear, and the 20 gr. doses of iodide of potassium were resumed twice daily. A mild Faradic current applied to the facial muscles daily for five minutes. There was considerable difficulty in swallowing for a few days, the granulations in the middle ear increased, especially in the upper portion of the tympanic cavity, and the discharge increased in proportion.

Under the treatment last indicated, with the addition of hypodermic administration of morphia at night, the patient's general condition improved, the pain in the ear diminished aside from the immediate effect of the opiate, the appetite and power of deglutition improved, and the granulations in the middle ear with the accompanying discharge considerably decreased, and on Aug. 16th

the discharge from the left ear was very slight and more healthy in character, but the patient complained of sharp pain in the right ear, which on examination exhibited congestion of the manubrial plexus and along the inner end of the external auditory canal. On the following day these symptoms had disappeared, but the discharge from the left ear had increased and become more offensive. There was general malaise, complaint of dull pain in different parts of the body, a weak pulse, and coated tongue. Ordered quinia 2 gr. every two hours, nourishing diet, and morphia $\frac{1}{8}$ gr. internally at night. On the following day there was increase of pain in the left ear, with redness, swelling, and tenderness over the mastoid; the application of leeches, however, entirely relieved these symptoms.

Aug. 21st the patient was seen by Dr. E. D. Spear, Jr., who advised, in addition to the present treatment, application of nitrate of silver to the granulations in the middle ear, which had again increased. From this date the patient again improved more or less steadily, with exception of a recurrence of the redness and tenderness over the mastoid, again readily relieved by leeching, and accompanying which there was pseudopia. Under the continued application of the Faradic current the facial paralysis seemed to slightly diminish, and on Sept. 14th the patient could nearly close the left eye. There were occasional attacks of severe frontal headache, but the severe pain was no longer referred directly to the ear. Sept. 29th there was, in addition to some swelling of the cervical glands, a commencing œdema of the left side of the face, the swelling appearing particularly in front of the ear and over the malar bone. On this date the patient was seen by Dr. Blake, who found destruction of the membrana tympani, granulations in the superior and posterior portions of the tympanic cavity, and on the posterior tympanic wall evidences of necrosed bone. The external auditory canal was clear, and there were no evidences of mastoid complication.

In the right ear there was found a considerable opacity of the membrana tympani, due to thickening of the mucous coat; the hearing distance for the watch was R. $\frac{0}{48}$, L. $\frac{6}{48}$. The prognosis given, both as to the facial paralysis and the ultimate result of the case,

was an unfavorable one. General supporting treatment, thorough cleansing of the ear and applications to the granulations in the posterior and superior portions of the tympanic cavity, were advised. Oct. 2d, the swelling of the face had considerably increased, and continued so to do for several days, finally extending to the right side of the face and head. There were occasional intense pains in the head, usually worse at night and decreasing toward morning. During this period the hearing in the right ear rapidly diminished, without evidence, however, of any inflammatory trouble in the middle ear. Under the treatment above indicated, with the addition of the exhibition of opiates as required, the patient gradually improved, with exception of attacks of nausea followed by great debility, on Oct. 26th and 29th.

The swelling of the face steadily diminished, and by Nov. 1st had entirely disappeared. By this date the patient was much better, appetite and digestion were good, she slept well, there was but little pain, and the discharge from the ear had greatly decreased. She seemed bright and intelligent, but was totally deaf. The facial paralysis remained unchanged.

Nov. 4th, her sentence having expired, she was discharged, and with a little assistance was able to walk to the office of the prison.

During the last months of treatment the temperature and pulse were taken twice daily. During a part of this time there was a variation of about a degree between morning and evening, but the temperature never rose above 100°—100.5° F., or the pulse above 84.

HEARING BY THE AID OF TISSUE CONDUCTION.— THE MOUTH-TRUMPET AND THE AUDIPHONE.

By SAMUEL SEXTON, M.D.,

NEW YORK.

The invention of the telephone and phonograph has greatly stimulated experimentation in the field of acoustics during the past two or three years, and especially have efforts been made to produce some instrument that would assist the partially deaf to better hearing.

Hearing through the teeth has been a familiar phenomenon for a long time, but, as far as is known to the writer, no attempt has, until of late, been made to use this channel practically for ordinary conversation.

Tissue-conduction (known usually as bone-conduction) is mentioned by the earlier writers on the ear, and one of them, Duverney, who wrote two hundred years ago, says that before his own day it was well known that musical sounds could be heard through the teeth, and that instances were known where the voice could be heard through the vertex. This writer was also aware of the fact that closing the external meatus increased the loudness of sounds heard by means of tissue-conduction.

Even before Duverney's time observations had been made on this subject. A literary friend has drawn my attention to the following allusion to this subject in a letter to be found in the *Diary and Correspondence of John Evelyn, F.R.S.* Mr. Evelyn, writing under the date of Aug. 27, 1668, says: "It is certaine that we heare more accurately when we hold our mouthes a little open, than when we keepe them shut, and I have heard of a dumb gentleman in England who was taught to speake (and, therefore, certainly brought to heare in some degree) by applying the head of a Bass-Viole hard against his teeth and striking upon the strings

with a bow. You may remember the late effect of the Drum, extending the Tympanum of a deafe person, to great improvement of his hearing, so long as that was beaten upon, and I could at present name a friend of mine who, though he be exceedingly thick of hearing, by applying a straite stick, of what length soever, provided it touch the instrument and his eare, dos perfectly, and with greate pleasure, heare every tune that is playd."

The only use, I believe, to which this knowledge has been put, is in testing the perceptive power of the terminal filaments of the auditory nerve—a test, in most instances, of probably less value than autophony.

Persons with defective hearing have often experienced the aid to audition afforded by a fan placed against the teeth. A patient informed the writer, some two years ago, of such an observation made in a large assembly of people whose voices were only an indistinct hum; she chanced, however, to place a palm-leaf fan to her teeth, and was greatly surprised to suddenly hear the conversation around her with great distinctness, although she could understand but little of what was said. This was reported to me at a time when I was much occupied with this very subject, but I failed to profit by the suggestion.

That the voice could be heard through the mouth when the conductive mechanism of the middle ear failed to perform its normal functions, was demonstrated by the writer several years ago.[1] The audiphone has since been found to convey the voice in the same way, the teeth being used to receive the vibrations in place of the mouth.

This first practical application of the sound-receiving power of the fan, when placed in contact with the teeth, was made by Richard S. Rhodes, a person who was himself deaf. His experiments led him to finally adopt a fan made of sheet vulcanite, as best suited to this purpose. The fan now found in the market, as manufactured under his patent, resembles somewhat the large palm-leaf fan, and the upper edge is slightly curved over, and held by silken cords which extend from the upper edge to the handle,

[1] Vide paper on *the relations of the conductive mechanism of the ear to abnormal hearing.* Samuel Sexton: Trans. Am. Otological Society, 1878.

where they are adjusted by a sliding ring. The necessary tension may also be obtained by pressing the upper edge of the fan against the teeth while it is held in the hand.

The teeth afford a direct osseous communication for the audiphone, except where they are separated from their alveolar attachments by a thin layer of tissue; but very good results can be obtained if the audiphone's handle be pressed against the temporal bone, either over the mastoid process or against the opening of the meatus externus. A bald-headed patient informs me that he hears somewhat with the handle placed over the parietal eminences. An obstacle, however, is found to conduction, when the head is thus used, by the interposition of its integumentary envelope, which is a poor conductor: but with improved appliances it is not unlikely that this difficulty may yet be overcome, and more convenient methods adopted than receiving through the teeth. The advantages of the teeth as receivers of sound cannot always be availed of, and in fact, a great number of individuals lose their hearing at an age when the teeth are also impaired.

The *modus operandi* of hearing through the tissues of the head is easily comprehended when the phenomena attending autophony are understood, the conditions that favor autophony admitting of the successful use of the mouth-trumpet and audiphone.

One of these conditions I believe to be a more or less change in the membrana tympani, especially its loss of proper tension from trophic changes, or from the results of inflammatory action; thus impaired, the membrane fails to perform its vibratory function in a normal manner. Or, the excursions of the membrane may fail of transmission to the labyrinth through displacement of the articular surfaces of the ossicula, the normal tension of the conductive apparatus of the middle ear thus being no longer maintained.

When the integrity of the membrana tympani and the chain of ossicles is thus impaired, sound-waves received by the teeth, or other parts of the head, may be transmitted through the bones, muscles, and other tissues of which the parts are composed, to the auditory nerve. Whether they finally gain access to the labyrinth

mainly through the base of the stapes, or not, is a problem requiring further research for its elucidation.

When hearing takes place through the tissues, say of the mouth or teeth, the undulations of sound probably reach the ear by the most direct route from the point of reception. I can, perhaps, refer with advantage to the following illustrative case that has just been before me: The patient is a gentleman, thirty-five years of age. His drum-membranes are untranslucent and relaxed, probably from catarrhal inflammation experienced in youth. His deafness manifested itself when he was about thirteen years old; at the age of nineteen he was very deaf, and now for the past thirteen years he has been unable to hear conversation unless loud and spoken directly into his ears. He himself speaks in a tone of voice so low that it is often difficult to hear him, yet he informs me that his voice is so audible to himself that he supposes he is speaking very loudly.

When his ears are closed by the pressure of his fingers, his voice (to himself) seems cavernous, or, as he expresses it, the words seem to enter some empty vessel, reminding him of the behavior of his voice when uttered while drinking water from an almost empty tin pail (an experience of early farm-life when his hearing was good). I can converse with him in an ordinary tone of voice through my mouth-trumpet (a flexible rubber tube of two and a half centimetres in diameter, extending into the back of his mouth). By means of the audiphone he hears ordinary voice, if distinctly spoken, about one metre. (It should be noted that the audiphone responds to vibrations best when received on its convex surface). Closing the ears does not seem to change the character of the sounds heard either by the tube or audiphone.

This gentleman informs me that he hears no better with the audiphone after several months' practice with it, than when he used it first.

The inconvenience of transporting the audiphone about and its conspicuousness when in use restrict him to its employment at home.

From observations made in a number of patients who have used the audiphone, I believe that as at present constructed its range of usefulness is rather limited. One patient, a lady, finds that the

instrument's use is quite a strain upon her, and she becomes very nervous in trying to hear with it; she can at best hear conversation poorly, even at a few spans' distance, and if more than one person is speaking at the same time, she is unable to follow them. Conversation heard through the audiphone is harsh,[1] but music is heard very well indeed. Her own voice (without the audiphone) she hears with almost painful distinctness, and the words spoken to her by means of my mouth-trumpet are heard with much ease.[2] The pressure of the audiphone against her teeth has, apparently, loosened one of them.

This patient has found that the vulcanite sheets of which these fans are constructed are exceedingly liable to fracture; she has lost one in that way, and has heard of others who have met with a similar loss.

I do not doubt that, when a knowledge of tissue-conduction of the head is more general, better instruments will be devised.

As far as my observations go I believe that those who experience autophony can derive more or less benefit from the audiphone if properly constructed—certain cases probably requiring larger receiving surfaces than others.

In some instances where autophony exists the tissue conduction is irregular and rough, thus lacking the smoothness of normal aërial conduction; and even when described by the patient as normal, as a matter of fact it usually possesses an unnatural timbre, as experienced by the gentleman above quoted, when speaking with his ears closed. Some patients describe the voice in autophony as distant, hollow, etc.

The quality of the voice heard through tissue-conduction, it may be suggested, depends on the different densities of the tissues through which sound travels on its way from the mouth to the ear. The cavities of the mouth, etc., where voice is moulded, so to speak, and also the cavity of the tympanum, where it finally arrives, both have their peculiar influences on its character. The

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[1] When the audiphone's sounds are harsh, or too loud, I have remedied this by pasting small sheets of paper on its convex surface.

[2] The mouth-trumpet is referred to in this paper only for the purpose of explaining tissue-conduction; it is not at all suited for general use.

buccal, pharyngeal and nasal cavities, lined as they are with a pliable, humid membrane, seem favorably constituted to take up aërial vibrations during speaking and singing, the vibrating air being urged upward by the lungs under these circumstances, with considerable force. The voice, as modified by the several chambers of the mouth above mentioned, is transmitted to the ear through better conducting media than air,[1] and, therefore, is intensified. The vocal sounds, before their final impingement on the labyrinthine walls, emerge into the tympanic cavity and the external auditory meatus, where they probably undergo further modifications, depending on the size of the cavity of the drum and contents, and perhaps also on the state of the membrana tympani. If the tympanum contained fluid in greater or less quantities, its presence would undoubtedly have an influence on the quality of the sounds; every one, almost, has had some experience in this direction when suffering from a cold in the head, the voice being "muffled" or otherwise altered. The external auditory canal also might be expected to exert its influence, probably as a sort of resonator.

The audiphone cannot aid the deaf mute in learning to talk by means of hearing his own voice, but it may, in some instances, assist him to obtain a better knowledge of the formation of words by hearing others talk. The deaf-mute in most instances, I believe, does hear his own voice; but, unless speech has been acquired before his deafness began, he has great difficulty in learning how words should be formed, his own voice not being sufficiently perfect to give him a correct idea of normal speech. Deaf-mutes who do not hear their own voice can never learn to talk intelligibly.

I believe the construction of mouth-trumpets, or some modification of the audiphone, would be of great service in the instruction of certain deaf-mutes.

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[1] In some instances, however, it should be stated, the Eustachian tubes seem to afford more or less aërial conduction.

BOOK NOTICES.

Die Krankheiten des Gehör-Organs im Kindesalter. Von Troeltsch: Tübingen, 1880, pp. 144.

This book constitutes a part of the large work on diseases of children which is now being published in Germany under the editorship of Prof. Gerhardt, the various divisions of the subject being assigned to different authors, so that the whole work, consisting of six volumes, forms a series of exhaustive monographs on all branches of the general subject.

In the treatment of his subject Prof. Troeltsch has been especially happy in uniting reliable, scientific pathology with rational therapeutics in a connected and easy style, which can scarcely fail to retain the interest of the reader throughout the book, a most important point in the writing of a specialist for the general practitioner.

The book is divided into five chapters: (1) Diseases of the External Ear, including congenital variations and malformations, diseases of the auricle and meatus, and of the drum-membrane; (2) Diseases of the Middle Ear, including acute inflammation of the middle ear or acute aural catarrh, simple chronic inflammation of the middle ear or chronic (non-purulent) aural catarrh, and finally, chronic inflammation of the middle ear with suppuration or chronic purulent aural catarrh; (3) Foreign Bodies; (4) Diseases of the Inner Ear or Labyrinth; (5) Deaf-mutism.

At the head of each chapter reference is made to the literature of the subject.

After discussing malformations in a succinct but sufficiently thorough manner, furuncle of the meatus is described and the clinical features of the disease in its different stages are very well given. The rupture of the furuncle is encouraged by moist warmth, warm water or oil, in the form of ear-baths continued for half an hour at a time; poultices are recommended directly to the meatus when there is great pain, but should not be continued longer than is absolutely necessary; incision is desirable if pain is intense, and the operation should be followed by occasional warm water injections. Painting with carbolized oil is considered of value to prevent the formation of furuncles.

Diffuse inflammation of the meatus in childhood is thought to be a not infrequent cause of some of the chronic otorrhœas seen in adults. Attention is called to the very variable course which the disease may run, and the varieties are described in full; a mucous secretion is certain evidence against the diagnosis of otitis externa, its existence being considered as proof positive that per-

foration of the drum-membrane exists or has existed. The possible evil results of the chronic disease are shown in full, attention being called in particular to the ossification-gaps in the osseous meatus of children, which readily allow extension of the inflammation to the parotid region. In treatment, leeches and warm ear-baths are advised in the congestive stage; syringing and drainage, with rolls of cotton wool, in the secreting stage. For parasitic inflammation thorough removal of the growth and the loosened epidermis is considered necessary, to be followed by the use of potassium permanganate, magnesia, alum, or sulphur powder, with salicylic acid. Warning is given against the use of poultices in this affection.

It is, however, unnecessary to go through the whole book calling attention to the individual features of each chapter. In such a work it is not a question of new and original ideas either of pathology or treatment, but rather of the judiciousness of the selections from our present universal knowledge, and also of the manner in which the subject is treated. In both of these respects we see nothing to wish changed. Pathology and treatment both receive their full share of attention, even in the most minute particulars, while important but still doubtful points are discussed very fully and impartially, and conclusions drawn either from existing evidence or from additional testimony furnished by the author.

In certain new ways of developing and discussing old subjects there is much of interest. Among these might be mentioned the anatomical and physiological causes for the predisposition to diseases of the tympanum which is seen in childhood, and also the discussion on the methods of testing the hearing and the effect of disease of the ear upon the patient's own speech.

No space is wasted upon unimportant points, and the book is eminently a practical one, more especially adapted to the general practitioner, but of interest also to the specialist. Its connected and fascinating style is one of its most prominent features.

Traité des Corps Étrangers en Chirurgie: Cinquième Partie. Corps Étrangers dans l'Oreille. Par A. Poullet. Paris, 1879.

This is a voluminous work of nearly eight hundred pages, and is written by the Superintendent of the Military Medical School at Val-de-Grace, France. The fifth part, consisting of over fifty pages, is devoted to a consideration of foreign bodies from without, which may affect the external ear. A curious error has crept into the author's mind, as evinced on page 676, where he speaks of a Politzer's eyelet as devised to provide a means of free issue of pus from the tympanum through the drum-membrane. This description of the instrument is given where the author is alluding to the possibility of this instrument's falling into the drum-cavity and causing the patient to run great dangers. If at the outset of a chapter of this kind an author shows such ignorance of his subject, there can be no wonder that aural therapeutics are constantly mis-

understood by the general medical practitioner, and that constant injustice is done this department of surgery. On the same page, too, the great danger of a pebble in the ear is dilated upon; but the danger, in our opinion, consisted in the efforts which the surgeon, H. Larrey, had made to extract it.

The author then proceeds to consider the subject under two heads, viz.: animate and inanimate bodies. In treating of inanimate foreign bodies, the author seems to think that much depends upon their shape and their physical properties. The latter, in our experience, would seem to have much more influence on the result than the former. Thus, the shape of an insoluble substance is of no moment in comparison to the extensible nature, let us say, of a bean or any organized vegetable substance, since the latter might enter as a small, smooth, hard substance, but become, by absorption of fluid matters which might come in contact with it in numerous ways, a very much larger, and hence more irritant, body than it was at the time of its entrance into the ear. In this chapter, the third, more might be said about the presence of maggots in the auditory canal, which constitutes the gravest form of living objects in the ear; and further accounts might be given of the pouring of hot lead into the external ear, which constitute at the outset, by virtue of the scalding it exerts, a most serious accident. In all other cases, perhaps the unskilful manipulations are the chief, if not the sole, causes of any grave complication, excepting, of course, some reflex phenomena which have occurred in some notable instances on record.

The fourth chapter is given to the consideration of the varied accidents supervening upon the entrance of foreign bodies into the ear. The phenomena thus brought out are divided into functional, subjective, and reflex, and those of compression, so-called. We should feel much better satisfied if, when alluding to the phenomena of the second class, on p. 683, the author did not make use of the expression "mucous membrane of the external auditory canal." It is a common error among French writers of the present day, but we cannot help believing that they are aware that there is no mucous membrane in this part of the ear.

Under the third head, that referring to reflex phenomena, there is presented an interesting account of salivation and hemierania. from the entrance of an earwig—whatever that may be—into the ear of a boy eight years old. The case is quoted from Latour, who, in 1846, reported it in a journal of military surgery.

The vertigo so frequently observed during the presence of a foreign body in the ear is ascribed to the pressure on the membrana tympani, the chain of bones, and the fluid of the labyrinth, according to the views of Toynbee, whom the author quotes in lieu of any better explanation, being apparently ignorant of the researches of Hasse and Weber-Liel into the intimate connection between the labyrinth fluid and the cerebro-spinal fluid.

In Chapter V., which treats of consecutive accidents and complications, we fail to see in the context, or in the cases cited, that the inflammation of the ear which ensued upon the entrance of a foreign body into the ear was not the result of the rough and unnecessary endeavors to extract it. In fact, the moral to be drawn is that in most cases it were better for the patient to have had his ear let alone entirely rather than to have been subjected to an examination "si peu méthodique" as to force the foreign substance, in itself innocuous, into the drum-cavity, and to finally produce meningitis and death. But the author, on p. 690, is imbued with the idea that the otitis may be produced simply by the *continued presence* of the foreign body in the ear—a condition which cannot be shown to be brought about by the simple insertion of an inanimate soluble or insoluble body, so long as it is either let alone entirely or attended to only by experts. A substance like a bead may remain in the ear fifty years and produce no graver lesion than an accumulation of cerumen, simply because the foreign body was let alone; and hygrometric substances, like a honey-locust bean, may remain for years in the external ear of a boy without any injury of any kind, because let alone; thus disproving that the *mere presence* of such things in the ear is necessarily injurious to the organ, or to the health of the individual. It must be admitted that in some instances the mere presence of such a substance in the ear will produce reflex phenomena, as shown not only by the author under consideration, but also by numerous other writers, from Fabricius Hildanus to those of the present day. But such affections are incomparably preferable to meningitis and death.

On p. 692 the author speaks of "accidents resulting from foreign bodies which wound the walls of the canal and the membrana tympani," going on to say that, "on account of their gravity, the accidents resulting from foreign bodies of irregular shape demand special attention." Under this head, pins and needles are mentioned—bodies not in themselves injurious if let alone or properly extracted; for it must be borne in mind that there is no motion brought to bear by nature on a foreign substance after it once passes into the external auditory canal. We have seen a pin which had slipped into the canal lie there without the slightest injury to the ear or discomfort to the patient. In fact, the patient, a woman, was inclined to think the pin had fallen out overnight, or in the street on her way to the surgeon's house. It was lying crosswise in the canal, and was easily lifted out with delicate forceps. But, under this head, we are glad to find the author admitting, in this class of cases, the "inconsiderate manœuvres of the patient or his physicians may very often transform a simple case into a complicated one," as, in fact, he shows on p. 694, where he tells of a fatal termination of a case in which a pin had slipped into the ear, but the rough manipulations of the friends of the patient had caused so much swelling, as well as enough pressure to force the pin into the tympanic cavity, and to set up a fatal meningitis.

In the sixth chapter the expulsion of foreign bodies and the termination of the eases are considered. There may be four kinds of terminations: 1. Tolerance; 2. Spontaneous expulsion; 3. They may remain in the ear and produce persistent functional or organic disorders; 4. They may produce death.

Under the first termination the result of swelling in hygrometric substances is forcibly enunciated. The author endeavors to show that a foreign body may remain in the ear as an innocuous substance until the ear gets a blow or a shock of any kind, when, "by the force thus applied to it, the foreign body seems to set up inflammation;" but may not the inflammation then set up be rather the direct result of injury to the ear, which is bound to occur, whether a foreign body be there or not? It seems like a confusion of cause and effect to insert into the pathologieal sequence the presence of a foreign body in the ear in such cases.

Spontaneous expulsion is spoken of as rare, and is only seen where the foreign body is alive, or where it is expelled by suppuration of the auditory canal. In the latter instance, judging from the context, the suppuration, however, is usually the result of unskilful endeavor to remove the offending substance.

Under the third caption, chronic nervous and inflammatory symptoms are spoken of, but very meagrely, though a vast amount of information on the nervous phenomena thus producible lies scattered throughout aural literature. But the author appears ignorant of the existence of any modern journals on otology in any language.

The fourth termination enumerated, viz.: death, is said to be rarely the direct result, though the author thinks it may be in some cases. But he does not prove it by any of the facts stated, nor by arguments deduced from reliable literature on the subject.

In the seventh chapter, which treats of the diagnosis and prognosis, the author admits that all foreign bodies in the ear are not attended with the same gravity, though he appears to think that the nature of some of the substances, as well as their shape, has much to do with the result. The importance of a careful and accurate diagnosis is urged, "as an error in this respect may be very prejudicial to the patient." The valuelessness of the statements of both the patient and his friends is pointed out and illustrated very well by the account of a child in whose left ear a shirt-button was said to have been put, but, upon careful examination by Löwenberg, the button was found lying harmlessly in the other, supposed to be entirely free. In this case the ear first said to be affected had become violently inflamed, by the unskilful endeavors at examination and extraction. In respect to the examination of the ear by means of the otoscope, the author appears to be entirely ignorant of the manner in vogue among aurists of accomplishing this important procedure. The ordinary Von Troeltsch mirror, with its focal distance of five to six inches, is

not mentioned, but, on the contrary, the use of an opthalmoscopic mirror is advised. At the same time the now superannuated specula of Toynbee and of Brunton are recommended—instruments which, from their weight and general arrangement, are extremely inconvenient, to say the least, and unless used with great care are sure to wound the auditory canal. Simplicity is not one of their recommendations. Then follows, under the head of exploration by touch, *i. e.*, by *probing*, a series of recitals of horrible results of unskilful treatment of foreign bodies in the ear, which of themselves were trivial, but in the end amounted to *malpractice*. This entire chapter is a solemn warning to all practitioners of medicine and surgery, that it is far better to leave the ear alone, when a foreign body is in it, than to make any endeavor to remove the substance, unless great familiarity with the subject makes the would-be healer perfectly sure that he is not going to do more harm than good. General principles of groping and probing in the auditory canal after a foreign body said to be there will accomplish nothing but the greatest injury to the ear.

The eighth and last chapter, in which the treatment is given, would naturally be looked forward to as one of the greatest interest. At the outset the author calls attention to the accidents which may result from improper treatment. The measures to be taken for the extraction of a foreign body are given by the author as of four kinds: 1. Extraction with forceps; 2. By means of drills, screw-drills; 3. By agglutination; and 4. By aspiration.

Under the first head, after alluding to the difficulty of extraction by this means, owing to the impossibility of getting both blades around the foreign body, the author suggests the following method; "For a long time" (he does not say how long, nor by whom suggested, nor how long such a procedure has been considered laughably incompetent) "it has been proposed to disjoint the blades of the forceps and insert them singly, with a view of rejoining them, and then the surgeon is to execute in the ear the same manœuvre as in the application of the obstetric forceps." Which is a *reductio ad absurdum*, from the mere fact that in one case the surgeon works in a large and extensible cavity, while in the other instance his labors are confined to a narrow, bony, and hence inextensible canal. We venture to say that the author has never attempted the extraction of a foreign body by the "obstetric method."

The second method is never necessary unless great force has been applied at the time the foreign body was introduced into the ear, or unless violence by unskilful manipulation has been employed in vain endeavors at extraction.

The third, that by extraction, is at least comparatively harmless; but the fourth, that by aspiration, is nothing more than a relict of antiquity, and a surgical curiosity, as employed in such cases, and in no way resembling the aspiration of the present day. It is simply a modified and imperfect form of suction, entirely barren of results.

Under the head of indirect extraction, there are mentioned: 1. Probes;

2. Hooks; 3. Curettes; 4. Curved forceps; and 5. Injections. In a work of general surgery all of them, excepting the last, should be recommended with the greatest caution, and syringing should be placed at the head rather than at the end of the list. Then the surgeon would probably try that first, and success would, in nine cases out of ten, crown his efforts, unless the ear had been culpably tampered with previously. Most of the instruments figured in the work had better be kept out of the ear, and recourse to syringing the ear should be recommended even more highly than it is by the author, though he admits that it, of all procedures, is the most useful, the most simple, and the least dangerous. Although the work just received is not such as an aurist would have compiled, it is, on the whole, a fair guide to the general surgeon, provided he will read between the lines the utter futility of rough procedures, and the great advantage of caution and gentleness in attempting to remove a foreign body from the ear. Let him also perceive that the mere presence of the vast majority of substances which are put into the ear are in themselves innocuous, and that their attempted removal has usually been the real cause of damage to the ear, whenever such has occurred. At the same time it is to be admitted that a foreign body should be removed from the ear sooner or later, or the hearing may become mechanically diminished, or nervous phenomena may be developed. Therefore, let deliberate, intelligent, and gentle endeavors be made to remove such possible cause of aural disease.

TAUBSTUMMHEIT UND DIE ERZIEHUNG DER TAUBSTUMMEN. DR. ARTHUR HARTMANN, of Berlin, pp. 212 and 19 tables: Stuttgart, F. Enke, 1880.

THIS book is the able successor of the works of Schmalz (1848), and of Meissner (1856). In its preparation, Dr. Hartmann has availed himself of the best extant literature of the subjects, and he has added to this valuable store his own observations and experiences. The nineteen chapters into which the book is divided treat of deafdumbness in general, peculiarities of the deaf-mute, our knowledge of deaf-muteness and its relation to idiocy and aphasia, statistics of deafdumbness, the returns of such statistics in general, the results of special statistics respecting congenital deafness, and also those respecting acquired deafness.

With the eighth chapter there begins an interesting and exhaustive account of the hearing-power of the deaf and dumb, which is followed, in the ninth chapter, by a consideration of the anatomical changes underlying deafdumbness. In the tenth chapter, the curability of deafdumbness is considered, but of course viewed from the scientific point, which reveals its impossibility as a rule. The succeeding chapters are given up to a thorough investigation of natural and artificial sign-language, the education of the deaf and dumb, at home and in a school, the history of the instruction of the deaf and dumb, and the fifteenth chapter is headed with the question, "What is attained?" In the sixteenth chapter the deaf and dumb are traced in their course after leaving school.

The last three chapters treat of the present condition of the education of the deaf and dumb, the legal rights of the deaf and dumb, and finally those afflicted with both deafdumbness and blindness are considered, and their education described.

In the first chapter, the author disposes of the very false popular idea, that besides their defective hearing, deaf-mutes have special deformities and diseases rendering them marked beings, in the following words: "If any one holding the heretofore commonly accepted opinion that in schools for the deaf-mute, weak and scrofulous children, with poorly-developed lungs are usually found, will take but a superficial view of such schools, he will be convinced that such an opinion is untenable. He will find lively, healthy children, and be convinced when he sees their proficiency in gymnastics and running that their lungs are anything else but weak."

And so in regard to their dispositions, he utterly rejects the idea that they are any worse than others, in which any one who has had the privilege of being with these unfortunates as physician or instructor, will corroborate the author. This most unjust idea as to their character has prevailed until comparatively lately, much to the misfortune of this class of our fellow-men, who really demand our greatest sympathy, and our best efforts for their amelioration by every medical or educational means. The fact is, that the open-heartedness and trustfulness of the deaf-mute is of such a kind as to win the heart of any one who is thrown with them. It must, however, not be lost sight of that the deaf-mute who is neglected, or whose efforts at making himself understood are laughed at, must necessarily become distrustful, ill-natured and selfish.

So far as their intellectual power and their memory are concerned, Dr. Hartmann claims, very justly we think, that they are as good as those of other persons, all other matters considered, in proof of which he narrates a story from Kruse (1853). "In 1805 a deaf and dumb boy was found by the police running at large in the streets of Prague. As no one could elicit anything from him, he was sent to the institution for deaf-mutes, where he was educated. When he was so far advanced as to give correct answers to the questions asked him, he gave a sketch of his former life, as far as he could remember it. He said his father had a mill, and he gave a good description of the furniture of his home and of its surroundings. He further stated that his mother and sister died, his father married again, and that his stepmother had treated him so badly that he had run away from home. He neither knew his own name nor that of the mill, but he knew that it lay "towards the morning" from Prague. Inquiries were made, and the boy's statements proved to be accurate. The police found his former home, gave him his name, and recovered for him his patrimony." In further proof of a good memory, the author adduces the aptness of the deaf and dumb in arithmetic.

Respecting the development of the other senses in the deaf-mute. Dr. Hartmann says: "In the blind, the senses of hearing and touch are sharply developed, but in the deaf, the eye becomes markedly sharp in observation. It is indeed surprising how easily a deaf-mute observes everything. While the hearing individual slowly receives an impression by his hearing very often, it will be found that already the deaf companion has seen it with his sharp eye. In many cases the mute attains such proficiency in reading spoken words, that he no longer gives the impression to those he meets that he is deaf."

The author further says: "It must not be supposed that mutes possess the ability to perceive sound by their skin, since the ability to analyze a complicated system of sound-waves, as occurs in spoken sounds, can exist only in a properly-developed terminal apparatus of the auditory nerve."

In alluding to the determination of the age at which a child may be said to hear, as well as to the tests for the existence of hearing in infants or in simulators of deafness, the author gives much of interest and of practical importance. So far as the young infant is concerned, the expression of its face, when in the presence of sounds, will be the best guide, and to test a malingerer, it would be well to take him unawares, if one is desirous to test his hearing. This may be done when he is asleep, drunk, or really wide awake, if one is skilful enough to catch him, as for instance, was the military officer who suspected one of his men of simulating deafness. When on parade one day, the officer whispered in the ear of the suspected man: "You ought to be ashamed of yourself, your pantaloons are unbuttoned." The soldier instantly clapped his hand on his fly, and in so doing he revealed his good hearing.

While admitting the existence of great differences in the statistics respecting the proportion of congenital deaf-mutes, to those having acquired the defect, Dr. Hartmann gives the results of his investigation as follows: In 2,658 deaf-mutes, 1,275 were found to be congenital cases, while 1,259 were found to have become so after birth. Lately, reports from Cologne and from Paris show a preponderance of acquired cases over the congenital. "However, it must be kept in mind, that in many cases it is impossible to determine whether the deafness is congenital or acquired. Since, in the early years of life, it is difficult to decide whether a child hears or not, the deafness, if it exist, is *found out*, during some attack of illness, because the child is more closely watched then than usual. Then it happens that the deafness is attributed to that particular illness. In some cases post-mortem examination reveals that a so-called congenital deafness really is dependent upon anomalies of formation. On the other hand it sometimes happens that a disease, which in early childhood induced the deafness, pursued an insidious course, without any visible external symptoms, so that the case may be erroneously classed with those of congenital deafness. It is therefore impossible to make these statistics perfectly reliable, yet they will approach certainty in proportion as the errors in both directions are rectified. Furthermore, the cases which have caused these errors are really

few, for as a rule the true cause of the deafness can be ascertained. Sometimes, in orphan asylums, neither the time of the occurrence nor the cause of the deafness can be found out, so that in the statistics there must appear the statement, cause uncertain. There are indeed some cases in which nothing can be ascertained, as in Cologne, where four mutes were found whose name even could not be obtained."

Deafmuteness may be inherited directly and indirectly, according to the author's observations, and the predisposition to this affection is more transmissible through the father than through the mother. Yet the converse has been shown by some investigators. The effect of the intermarriage of relations upon the production of deafdumbness is not at all settled, but the influence of unfavorable social relations has apparently much more to do with the production of this defect. And yet the author is not prepared to make any positive statements as to the effect of the employment and the life of the parents upon the children, so far as making the latter deaf is concerned.

The oft-asserted theory that ill-health in the parents is the cause of deafdumbness cannot be sustained by statistics. In some instances where several mutes were found in the same family, their parents were known to possess good health. Also, the assertion of French authors, that intemperance in strong drink on the parents' part is the cause of deafdumbness in the children, cannot be substantiated. Not until the percentage of drunkards in general, and that too of the parents of deaf-mutes, is ascertained, can the effect of the intemperate use of alcohol in the production of this defect in the offspring be determined. In fact, all the popular reasons for congenital deafdumbness, such as excitement during pregnancy, frights, preponderance of the age of the mother over that of the father, etc., are to be cast aside as erroneous.

If a child loses its hearing before it is seven years old, as a rule the power of speech goes too. In 641 cases of deafness, more than two-thirds (424 cases) acquired their defect in the first year of life, 124 in the fourth and fifth years, and 52 cases in later years, while in 19 cases the exact time of becoming deaf could not be determined. Congenital deafness is chiefly transmitted by the parent, but acquired deafness is usually the result of disease which has destroyed the sound perceiving organs. Most of these diseases are not peculiar to the organ of hearing, but the hearing is destroyed, for example, by inflammation of the brain and of its membranes, and also by general diseases, which have at the same time affected the ear and produced deafness. According to Hartmann, the diseases most likely to produce deafness are as follows: Diseases of the brain (inflammations, fits, convulsions, etc.) 323; typhus fever (typhoid), 116; scarlet fever, 94; measles, 30; idiopathic diseases of the ear, 45; injuries of the head, 30; and other diseases 194, in a total of 832 cases. Deafdumbness following scarlet fever, is not due, according to Dr. Hartmann's investigations, to otorrhœa and perforation of their membrana tympani, but to an attendant disease of the labyrinth. Both typhus

and scarlet fever may affect the brain, and this seems to have been the case in those instances of deafness following them, and in which the labyrinth has been in all probability diseased from the cerebral affection. In proof of this, the author states that in many cases of total deafness following these diseases, the membrana tympani has been found normal, while only in a small minority has the drum-head shown cicatrices, calcareous spots or perforations, which could be attributed to the preceding disease of the middle ear. In only a very few cases was there a chronic otorrhœa.

The statistics of the deaf and dumb cannot furnish accurate data as to the effect of naso-pharyngeal catarrh in the production of deafness in the early years of life. In order to decide this point, deaf and dumb children should be examined early in life, which indeed aurists have the chance of doing.

Dr. Hartmann has had an opportunity of examining a number of children whose parents had brought them to him because they had not yet learned to talk. In most of these cases examination revealed a naso-pharyngeal catarrh, which upon treatment was cured. At the same time treatment of the ears was conducted and the catarrh cured, whereupon the children would rapidly learn to talk. In some cases, however, all treatment was in vain. In the case of a girl 14 years old, an orphan, whose deafdumbness was apparently caused by chronic naso-pharyngeal catarrh, it was not possible to find out whether she had heard in early childhood. Both of her tonsils were enormously hypertrophied and were cut out, the mucous membrane of the naso-pharyngeal space, especially the pharyngeal tonsil, was greatly swollen and hyperæmic, while the turbinated bones were greatly enlarged at their posterior parts. The membrana tympani was indrawn on both sides, just as it is in cases of chronic stenosis of the Eustachian tube. Enough hearing remained on the left side to enable the child to hear loudly spoken words and to repeat them, but on the right side merely the sound of the voice was heard. Treatment was of no avail in this case; but what might not have been attained, not only in this case, but in thousands of others, by early and efficient treatment! Dr. Hartmann most justly says, "I shall meet with no contradiction from my colleagues in otology, if I assert that just such cases could be cured if treated in time." When alluding to the effect of injuries to the head, upon hearing, the author gives a case observed by himself, in which deafness was caused without doubt at the time of birth. The mother was delivered with great difficulty, by means of the forceps, and after the child was born not only its head was deformed, but facial paralysis existed on one side.

Chapter VIII. opens a subject of interest and importance, in the consideration of the "Hearing power in the deaf and dumb." "In a large number of cases of deafdumbness, the deafness is not absolute, but there still exists a considerable degree of hearing." The fact is not known by the public, and hence they have been astounded and misled by certain equivocal statements which have appeared of late, not only in private circulars but in the daily

papers, that the "deaf and dumb are made to hear," and in some cases this falsehood is accompanied by an equally doubtful assertion, viz., that the dumb are made to talk by using artificial means of hearing. It is not easy to disprove a negative; but all who know anything about the deaf and dumb, know that most of them have some hearing left, which enables them to perceive loud sounds, but not enough by any means to enable them to learn to talk by hearing others talk. It becomes our duty, therefore, to say that *no means has yet been discovered* sufficient to enable deaf-mutes to hear well enough to learn to talk, which of course is equivalent to saying they cannot yet be made to hear. It may be stated here that there are very few *absolutely* deaf among the deaf and dumb, according to some observers; but Dr. Hartmann has compiled statistics from the best authorities which show that more than sixty per cent. of all mutes are absolutely deaf, one-quarter can hear loud sounds, and one-seventh can hear vowel sounds and words, of course with difficulty.

Dr. Hartmann recommends that the hearing-power of all mutes should be tested when they are admitted to an institution of learning, in order to find out what chances they may have of being taught to articulate. He has found in his examinations that the power of the two ears in mutes is very often different, which, though it is as might have been supposed, has not been regarded as it should have been. "If there is a difference of hearing, a heavy tuning-fork, placed in the median line of the skull, will be perceived by the better hearing ear." Usually mutes are aware whether they can hear or not, for in the first instance they often have a chance to hear reports of cannons, loud whistling, clapping of hands, music, etc. The latter, in fact, is often perceived by mutes. A pupil of the Berlin Institution has learned to sing the "Wacht am Rhein," but with a defective articulation, so that the melody is more readily understood than the text.

Mutes learn to play on the piano, not only from the notes but from memory. In their celebrations music is always furnished by the deaf and dumb, since a number of them can hear it and gain great pleasure from it.

Respecting the anatomical changes which underlie deafdumbness our knowledge is unfortunately limited. There are, it is true, a number of post-mortem examinations of mutes on record, which Dr. Hartmann has arranged in a valuable table, but, as he says, "these are partially defective, made in some cases long ago, and sometimes nothing of the previous history of the mute is known; again, not even the cause which was assigned during life for the deafness, is stated. Hence we have no autopsies of deaf-mutes born of marriages between blood-relations, nor of those who had acquired the defect, though of just such cases it is of the most importance to know what organic changes underlie the deafness, whether in fact in both kinds of cases the same changes exist or not." He then considers malformations of the ear, anatomical changes

in the middle ear, anatomical changes in the labyrinth and in the auditory nerve, in its entirety, and changes in the brain.

In the tenth chapter the "curability of deafdumbness" is considered, but it is chiefly a record of audacious and outrageous impositions practised heretofore on the deaf and dumb and their too credulous relations. In some cases an organic change in the ear may be corrected, but these cases are very few, and in any case whatever is to be done must be done quickly, *i. e.*, early in the life of the mute. On p. 107, Dr. Hartmann says, "It must be distinctly stated, as specially desirable, that to the coming physician an opportunity should be given during his studies to become acquainted with otology, and that he should be obliged, in his examination for his degree, to give proof that he at least knows how to examine an ear, and is familiar with the simplest means of treatment. There is no doubt that if such conditions were obligatory and fulfilled, the occurrence of deafdumbness might be warded off." Furthermore, aside from the fact that by proper treatment deafdumbness might be prevented, if physicians were properly instructed as above shown, it is highly necessary that they should also be familiar with the nature of deafdumbness and the methods of instructing mutes, so that they may give proper advice and direction to parents of mutes, regarding their education. This chapter closes with the practical observation that "The chronic otorrhœa with offensive discharge, often found among mutes, should be cured not so much because thereby the hearing might be restored, but because, in any case, if it is not cured the disease may spread to the brain."

Dr. Hartmann is not a friend of sign-language for the deaf and dumb, and holds, that of all these methods, that of Augustin Gosselin, called "Phonomimie," recently reviewed in this Journal, Vol. II., No. 1, in a critique of Coldefy's paper, is especially unworthy of use. As an indication of the adverse feeling toward dactylology or the finger language, the author cites the limited field in which it is used, since it is almost entirely confined to France; in fact, to Paris.

The subject of the instruction of the deaf and dumb introduces a careful scientific consideration of the physiology of speech and their instruction in articulation, which is followed by the fifteenth chapter, devoted entirely to a discussion of the results attained by instructing mutes in this manner. The subject is considered with the greatest fairness, as it seems to us, while the author is evidently a friend to the method of instructing mutes in the use of speech according to the German method, which undoubtedly is the best method yet produced. A very important fact is brought out in this chapter, that it is one thing to instruct mutes to use speech, and another thing to educate them *by* it. While it is an immense advantage to a mute to learn to talk, and to understand speech, it requires, in the best of cases, early beginning and *time*, great labor on the teacher's part, and a selection of cases, for many mutes can never learn to talk, on account of intellectual deficiency. Then, too, per-

severance in the use of speech is requisite on the part of the mute, or he will lose what has taken him four or five years to acquire. As it is so difficult to teach mute children to talk, great caution is requisite, that, in the enthusiasm to teach them this great accomplishment, the matter of education is not neglected. The best plan would seem to be one that made speech not an end only, but a means of education. Until this is done, sign-language must take precedence of speech, in the education of mutes, on account of the convenience, cheapness, and greater applicability, in *all* cases, of the former method. Yet the time must come, in our opinion, when vastly more will be done than even at present, in all lands, to give all mutes a perfect chance to learn to use and understand speech. Dr. Hartmann gives, as his opinion, "That, under especially favorable circumstances, if a deaf-mute is constantly stimulated to use speech after he has learned it, so that he can learn as much as the good hearer can, and if he can perfect himself by private instruction, in addition to what he can get in a school for mutes, then he will have as good a chance as one with full hearing, to understand lectures, and even learn foreign languages, thus extending his education, and preparing himself for any calling. He is then no worse off than one who has lost his hearing in adult life. Perhaps he has some advantage over the latter, in that the mute has learned to read the lips, whereby he is better able to associate with others."

Want of time and space obliges us to end our review of this extremely interesting book. In conclusion we can say, that every one occupied in teaching deaf-mutes would do well to read it, if he has command of German, and make himself familiar with the facts and hints it contains, while every aurist should be fully acquainted with the contents of this work.

Vocal Physiology and Hygiene. A Treatise on Vocal Physiology and Hygiene; with Especial Reference to the Cultivation and Preservation of the Voice. By Gordon Holmes (Edinburgh: Churchill. 1879): *Nature*, Jan. 22, 1880.

It is one of the most singular facts connected with music that, notwithstanding the very wide spread of musical education, the kind of performance which is within the most general reach, namely, singing, receives the least amount of earnest culture.

If a girl who finds she can sing a little, asks for some lessons from an ordinary teacher, we know pretty well what will be done: there may be, just as a matter of form, a few exercises given; but the great aim will be to teach her the notes of certain songs, so as to provide her with a small repertory for social exhibition. If we go a little further and include the cases where the teachers endeavor to give their pupils some idea of style, we about exhaust the category of vocal instruction which is common in private circles, and we need not wonder at the fact that, to educated judges, ordinary amateur singing, when it is not offensive, is, at all events, wretchedly poor. To learn to

sing in the proper sense of the word is quite a different thing from learning songs. The voice is an instrument, the capabilities of which, in many respects, transcend those of any other known; and the cultivation of the voice, and of the singer's power over it, so as to use it to the best advantage, requires not only careful and judicious training, but long, hard, and laborious practice. It is consequently only among the professional ranks that we are accustomed to expect thoroughly good singing, and even here, whether from deficient education, imperfect powers, or defective taste, it is not often that what is expected is really found.

Undoubtedly one of the great causes of the evil is the general ignorance as to the nature of the voice and the manner in which it admits of management; and the appearance of a book which sets forth these and kindred topics in a way that cannot fail to be largely useful, is welcomed with pleasure. Although written by a man who is fully conversant with all the technicalities of his subject, it is yet essentially popular in its style, and may be studied with advantage by all who are interested in the cultivation of the voice for any object whatever.

The introduction and the first chapter are devoted to an Historical Review of the Origin and Progress of Vocal Culture, and to an explanation of the general nature of musical sounds. These are somewhat lengthy, occupying one-fourth of the book; but one may fairly allow for the author's wish to render his treatment of the subject complete. In the remainder of the work he is more clearly on his own ground. Chapter II. is devoted to a description of the anatomical construction of the vocal organs, and Chapter III. to an investigation of their physiological mode of action. Both these are admirably treated of, and are illustrated, where necessary, by copious figures. The author gives, under the latter head, an interesting survey of the various theoretical attempts that were made to explain the vocal phenomena before the great invention of the laryngoscope, in 1854, by Manuel Garcia, gave the power of actually observing the processes at work.

Chapter IV. is the one to which, probably, the greatest importance is to be attached; it treats of "The Physiological Principles of Vocal Culture." The author says:

"The cultivation of the voice, amongst civilized nations, has for its object the complementary development of the powers of organs which have already attained a high degree of perfection in the performance of their functions. Through the exertion of influences acting from without, and not directly controlled by the will, man proceeds instinctively and intuitively as a mere agent to the evolution of speech and language. But here, as in many other of his relations, beyond a certain point the unerring guide of nature leaves or only follows him with a perpetually widening interval, and his further advance is made voluntarily and with self-consciousness of his aim. . . .

Hence we may recognize two grades in the employment of the voice—the first necessitated by the conditions of social life as a means of intercommunion, and the second undertaken with a view to the æsthetic observation of the listeners.

"The technical training of the voice lies immediately in the hands of teachers of elocution and singing. On their taste and genius, as well as on the aptitude and natural vocal gifts of their pupils, depend, in the greatest measure, the success obtained and the perfection of the result.

"But, whatever methods be adopted, the base of operations is vital organization and action, of which the true apprehension and normal guidance must lead most directly and certainly to the desired end."

The reviewer says: "This, we take it, is the great aim, and the most useful tendency of the book, namely, in the first place to make known to those who desire to excel, either in singing or in elocution, that something more is necessary than they can obtain by the mere light of nature; and secondly, to enunciate the important truth that the art of using the voice to the best advantage can only be effectively taught by the aid of a competent knowledge of the nature and capabilities of the natural organ—matters of which great numbers of those who profess to teach have absolutely no idea at all. The value, therefore, of such information as is conveyed in this work, both to teachers and learners, can scarcely be overrated. It is not possible here to enter into details; suffice it to say that the chapter treats fully of vocal force, timbre, compass, and execution; of the modes of development; of the management of respiration; of the vibrating elements, the resonance apparatus, and the articulation; and it adds some useful data as to the treatment of that troublesome vocal defect—stammering."

The last chapter is devoted to a subject of vital interest to those who have to make public use of the voice, namely, vocal *hygiene*. The maintenance of the vocal powers is a matter of no less importance than their cultivation; but there is much ignorance and misunderstanding on this point, and the advice the author gives, coming as it does from one having authority, is most valuable.

REVIEWS.

Lecture Experiments in Acoustics. Sylvanus P. Thompson: *Philosophical Magazine*, Jan., 1880. p. 75.

1 *Propagation of a Longitudinal Wave.*—A piece of apparatus for illustrating the propagation of a longitudinal disturbance more effectively than the customary rows of suspended ivory balls, or of glass balls laid in a groove upon a table, is made by hanging to a wooden rod a row of the balls of thin caoutchouc distended with air, which are sold colored for children's toys. There is enough tangential friction, if properly arranged, to allow of the propagation of a transversal disturbance being also shown.

2. *Demonstration of Vowel Qualities.*—The usual demonstration of the part played by the various cavities and positions of the throat and mouth in producing vowel qualities of tone is to set the air in them vibrating by resonance to the tones of appropriately chosen tuning-forks, corresponding to a harmonic series, held in front of the open mouth. The jews-harp with its simple reed set vibrating by the finger affords a capital adjunct to the experiments with tuning-forks.

The entire set of vowel-sounds, and even such simple phrases as "Who are you?" (minus the consonantal sounds) may be produced by the jews-harp in the following manner: The instrument is held against the slightly opened teeth in the usual manner for playing. The operator then adjusts his throat and mouth as if to pronounce the desired vowel or vowels, and, breathing softly to sustain the vibrations of the reed, strikes the tuned-up end or tongue with his forefinger. An audience of one or two hundred people can hear the sounds without difficulty.

3. *Illustration of Compounding a Rectilinear Vibration with a Simple Translation at Right Angles to it.*—Let a straight piece of stout clock-spring or of flat steel "crinoline wire" be fastened to a suitable handle, and a heavy silvered bead be attached to the other end.

If this be kept vibrating, the bright point produced by viewing a light by reflection in the spherical surface of the bead appears drawn out into a line of light.

If the spring be held in a horizontal plane, this line is of course vertical. Let the spring be then moved in the hand with a swift horizontal motion of translation; the line of light will then appear drawn out into a luminous sinus-oidal curve.

An investigation of the behavior of membranes in sounding columns of air, by KOHLRAUSCH (*Wied. Ann.*, No. 12), shows the following results (which sufficiently indicate the line of research):

1. Open membranes (freely in contact with the air on both sides) vibrate in the ventral segments of stationary waves, and come to rest in the nodes; covered membranes (shut off from the external air on one side) vibrate in the nodes and come to rest in the ventral segments.

2. A fine open membrane stretched over a ring is a *very sensitive* means of determining the position of the nodes in stationary waves.

3. If a solid body be brought between two nodes of the stationary vibrations of a pipe, the half-wave between these two nodes contracts while the others are lengthened, and the pipe gives a tone corresponding to the longer half-waves, consequently a deeper one.

ON A METHOD OF STUDYING THE REFLECTION OF SOUND-WAVES. O. N. ROOD: *Am. Jour. Science and Arts*, Feb., 1880, p. 133.—It has been the custom for several years to introduce, in certain forms of the melodeon, a revolving fan for the purpose of obtaining rapid alternations in the intensity of the notes. This arrangement is called a "tremolo," and its action was considered by its inventor, and by those interested in it, to depend on the currents of air produced by the motion of the fan. An examination of this apparatus convinced Prof. Rood that this idea was erroneous, and that the alternations in the loudness of the sound were due to reflection or non-reflection from the face of the revolving fan, it being found that the same effect could be produced by means of a circular disk, consisting of open and closed sectors and revolving in its own plane.

Experiments with this apparatus easily demonstrated that—

1. At a perpendicular incidence the short sound-waves are more copiously reflected than those that are longer, and the regular reflection is more copious from large than from small surfaces.

The diameter of the zinc disk was in the first set of experiments 21 inches= 53.3 centimetres; alternate quadrants were removed, and the rate of rotation varied from two to four turns in a second. The tuning-forks were mounted on their resonance boxes and gradually removed away from the revolving disk till the alternations could no longer be distinguished by the ear placed near the fork. The results are given in the table below, "distance" indicating that of the open end of the tuning fork from the disk.

Diameter of Disk, 21 *inches*.

Ut_3 fork;	alternations	heard	at	13	inches	distance.
Ut_4 "	"	"	"	20	"	"
Ut_5 "	"	"	"	96	"	"

When the same experiments were made with a disk having a diameter of

only $8\frac{1}{2}$ inches=21.5 centimetres, it was found necessary to bring the forks much nearer the disk before the alternations could be perceived.

Diameter of Disk, $8\frac{1}{2}$ inches.

Ut_3 fork;	alternations	heard	at 2	inches	distance.
Ut_4 "	"	"	" 3	"	"
Ut_5 "	"	"	" 6	"	"

2. When the sound-waves fall upon small, flat surfaces at an acute angle, the reflection is most copious in the same direction as with light, but the reflected and inflected waves can be traced all around the semicircle.

Experiments on this point were made in the open air, the larger disk being used with angles of 60° and 70° (from the perpendicular): the Ut_4 and Ut forks were employed. The regularly reflected waves could be heard at a distance of ten or twenty feet from the disk, the fork being held a foot or two from it; inflected waves were easily distinguishable all around the disk, and even a few feet behind the fork. When the forks were placed in the plane of the disk, the alternations of loudness were reduced to a minimum, but in the open air and in a room never wholly disappeared. This is supposed, by the author, to be due to the fact that the source of sound is not a point, but a surface.

Even, under these circumstances, feeble alternations were heard all around the disk, the inflected waves actually returning to their source. With a plain disk, alternations were not perceived.

3. Qualitative comparisons between the power of different substances to reflect sound can be easily made.

For example, the disk of card-board, in which filter-paper is fastened over the open sectors, gives alternations owing to the difference of the reflective powers of the two substances.

4. If a composite sound-wave falls on the rotating disk, the shorter waves will undergo regular reflection more copiously than the other components.

This experiment is most easily made with a reed without its pipe. Ut_3, Ut_4, Ut_5 reeds give alternations but mainly in their high overtones; the alternations have, consequently, a metallic, ringing sound.

5. The reflection of sound from very small surfaces is easily demonstrated.

If an Ut_3 or Ut_4 reed, without its pipe, be employed, alternations are easily obtained by moving a visiting card properly near the reed. By substituting a gas flame for the card, the reflection from the flame can be demonstrated. The gas-burner should be attached to a long, slender rod. Almost all of these experiments are so easily performed as to be suitable for lecture-room purposes.

Otitis in a Tuberculous Subject; Suppuration in the Tympanum; Trepanation of the Mastoid Apophysis; Cure. Dr. Gillette: *Annales des maladies de l'oreille*, November, 1879.—This is an account of tuberculous

disease: first, of the testicle, then of the right ear, of a subject fifty-four years old. Fifteen months before his admission to the Hospice de Bicêtre, he had received a blow from a stone on the occipital region, which was followed by a bloody discharge from the right ear. In the course of three months the hearing failed in this ear very markedly, and a chronic, purulent, fetid discharge set in. An examination with Toynbee's otoscope revealed "an external otitis, with a pale and prominent membrana tympani, without perforation."

Weak and emollient carbolized solutions relieved somewhat the discharge, but did not cure it; but as the chest-symptoms, and those in the hydrocele, were much better, the man was dismissed. In about six weeks he returned to the hospital with increased otorrhœa, which broke out at certain periods in large quantities, after intense pain. Tinnitus and roaring in the ear were excessive, and the hearing was nearly gone. All around the auricle, and especially over the mastoid, there was great swelling and tenderness on pressure. But there was no œdema, although the pain in the head was intense, and there were attacks of vertigo. His face was flushed, bluish in color, and his nights disturbed; pulse frequent, with diarrhœa and sweats.

The continued use of carbolized washes for several days longer gave no relief. The pain continued to be violent, and the patient's complaints of distress in the side of the head and mastoid region leading to the fear of inflammation of the meninges, Dr. Gillette determined to trephine the mastoid portion.

After anæsthesia, a crucial incision was made over the mastoid region, reaching to the bone, and after the periosteum was scraped away a small crown of a trephine was placed at a point corresponding to the intersection of two lines, the one vertical, situated 1.50 cm. from the attachment of the auricle, and the other horizontal, passing through the upper wall of the external auditory canal. The disk of bone removed seemed healthy. Then, by means of the gouge and hammer, the antrum mastoideum was reached, by working forward and inward. The pieces of bone removed by this process appeared eburnated and the seat of a hyperostosis (ostéite condensante). A venous hemorrhage ensued, chiefly from vascular fungosities, but was easily checked by tampons of carbolized agaric.

"No pus was observed to run from the opening in the bone, probably on account of the hemorrhage." An injection of carbolized water, through the mastoid opening, issued from the external auditory canal, proving in the opinion of the operator the existence of a perforation in the membrana tympani; but there may have been a sinuous connection between the mastoid cavity and the external auditory canal, with the drum-head imperforate, since such cases have been noticed.

A probe passed from the mastoid opening toward the ear was felt by the surgeon's finger in the external auditory canal, and a drainage-tube was finally

passed through the mastoid opening and out through the meatus externus, thus showing, in our opinion, the existence of a sinus between the mastoid cells and the posterior wall of the external auditory canal. Lister's dressing and compression were then applied, and the patient, on recovery of consciousness, expressed himself as free from pain. For five days nothing abnormal occurred, the otorrhœa continued abundant, and three times daily the ear was syringed with carbolized injections through the drainage-tube; but on the evening of the fifth day after the operation the patient was suddenly seized with vertigo and a sensation of trembling throughout the *entire left* side of the body, loss of consciousness, general convulsive movements, stiffness of the limbs, and mumbling. After a copious bleeding by the interne, the patient recovered consciousness almost immediately. For a few days following, nothing of note occurred excepting some slight rigors throughout the left side of the body. The carbolic injections were continued and his general condition was good, considering his lungs. The hearing improved notwithstanding the presence of the drainage tube, according to the statements of the surgeon, and this leads us all the more to think that the drainage-tube was not passed from the mastoid cells through the tympanic cavity and through a perforation in the membrana tympani, as this could not have been maintained and the hearing improved, if indeed such a tube could have been thus placed without destruction of some of the ossicles of hearing and excessive laceration of the membrana tympani. We are in fact, therefore, fully of the opinion that the operator has not expressed himself clearly regarding the true state of the diseased parts, viz., that the mastoid cells and antrum were connected with the external auditory canal by means of a sinus—a not uncommon condition, and that through this the drainage-tube, as well as the fluids injected through the mastoid opening, were passed.

In little more than a month the ear had entirely healed.

Carcinoma of the Middle Ear and Petrous Bone, with Destruction of Part of the Base of the Skull and the Atlas. Reported by M. Assaky, from the service of M. Polaillon, of the Pitié, Paris: *Annales des maladies de l'oreille, etc.*, November, 1879.—The subject of this disease was a man thirty years old, admitted to the hospital on the 11th of October, 1878. He stated that his right ear had been diseased from childhood. He had grown, however, into a large and generally healthy man. At the time of his entrance into the hospital, the deafness of the right ear was found to be complete, the mastoid region swollen, and the otorrhœa was purulent.

The auditory canal was filled with bright red granulations, and a probe passed beyond these penetrated into the petrous bone. There was at the same time an incipient facial paralysis. In the course of two months the auricle was gradually pushed away from its natural position by the intense tumefac-

tion which gradually invaded the temporal, mastoid, and masseteric regions. Soon this swelling became enormous and fluctuating, and two incisions were made in it by M. Polaillon—one over the mastoid surface, and the other a little in advance of the condyle of the inferior maxilla; and through the two a drainage-tube was passed. A large quantity of pus escaped, and for *several months*, daily washings with carbolized solutions were made through the drainage-tube. But the abscess did not heal; on the contrary, new points of suppuration formed on the nucha and on the side of the neck, and these had to be opened.

By the month of June, nine months after admission to the hospital, the local conditions were as follows: "The right aural region was the seat of a hard and painful swelling, extending over the entire temporal fossa, the mastoid region, and encroaching on the facial region to below the orbit. This swelling continued, by an œdematous hardening behind, as far as the external occipital crest and the superior linea semicircularis, and below and in front, to within two fingers' breadth of the lower border of the inferior maxilla." The skin was tense, shining, and presented at some points erythematous plaques. Behind the auricle there was a concave growth of a wine-red color, and another red furrow over the region of the submaxillary groove. The auricle itself was the seat of a subcutaneous infiltration, which increased its size and obliterated its elevations and depressions. About the auricle were three small, pale ulcerations, with everted edges, and about as large as a franc piece (quarter-dollar). One of these was behind the auricle, near the line of the upper part of the helix; the other two were in front—one, two centimetres above the temporo-maxillary joint, and the other on a line with the lobule. A fourth ulceration, cleft-like, elongated, as it were, the flexure between the auricle and the mastoid portion. The auricle was abnormally movable, and its movement was painful to the patient. Ichorous pus flowed from the points named whenever the auricle was manipulated. All these openings, when probed, seemed to lead to a common focus, viz., toward the tympanum. The probe, at a distance inward of about six centimetres, struck a soft, carious bone-substance, and this examination was followed by a sanguineous discharge. Injections passed through any one of these openings escaped by the others. At the mouth of the auditory canal there was a red, soft, polypoid mass. The facial paralysis on the right side was complete, with deviation of the tongue and the velum palati, and with paralysis of the orbicularis palpebrarum.

Palpation of the soft parts of the neck, where the œdema had not extended, induced excessive pain at certain points. This pain was induced each time pressure was exerted along the tract of the pneumogastric nerve and the sides of the larynx and trachea. On account of the emaciation of the patient, the tip of the finger could be thrust between the larynx and the œsophagus.

Compression of the recurrent caused the patient to scream. All these symptoms were producible only on the right side. The trapezius and the sterno-mastoid had lost their activity, and the result was that the shoulder hung far down and forward, with the posterior face of the scapula turned outward. Hence, the spinal edge of the bone, detached from the thoraeic wall, projected under the skin, giving to the scapula the appearance of a wing. The fossæ, above and below the spine of this bone, were excavated, and the projection of the clavicle was very marked. The carotid region was flattened, and the sterno-cleido-mastoid muscle was not thrown into relief by the movements of the head. When asked to sit up, the patient would direct his right hand, with much faltering, toward the fastenings of his bed, and slip his left hand between the pillow and his nucha. He would then raise himself with his right hand thus fixed, and with his left hand holding his head. This change of position put him out of breath, and brought about on the *left* side a dilatation of the pupil, which, the writer says, had been observed in this patient before upon the slightest movement. The right pupil remained in a state of moderate contraction, a condition which had succeeded, for some time, alternations of contraction and dilatation, which occurred without appreciable cause, conjointly with sudden and fleeting congestions of the face and ear of the same side. His appetite was good, though chewing was difficult and painful, and at times he suffered with dysphagia, occurring irregularly and lasting for periods of variable length. The sense of taste seemed to be intact in a general sense. Nevertheless, there was a marked difference between the two sides of the tongue, the right side being impaired.

Titillation of the velum, the half arches, the base of the tongue, and of the uvula even, could not produce any reflex movement. The tongue was dry, though the patient spat a considerable quantity of transparent non-aërated saliva. The latter was amphi-chromatic, as it turned the red paper blue, and turned the blue paper red. Upon one occasion the saliva was decidedly acid. Respiration was laborious, varying from eighteen to twenty-two. Inspiration lasted one-half second, while expiration lasted one second, and the respiratory pause two seconds. The cough was hard and hoarse, and the voice resembled that of an individual with one paralyzed vocal cord. Wheezing ensued upon the slightest exertion of any kind. His pulse was not compressible, and ranged from eighty to eighty-eight per minute. The urine was dark in color, but contained no albumen or casts. The solution of Barreswill at times revealed the presence of a small amount of glucose.

En résumé, there were found complete loss of innervation of the facial and spinal accessory, and disturbed function of the glosso-pharyngeal, the pneumogastric and great hypoglossal, being results of the lesion of the petrous bone and of the *foramen lacerum posticum.* The intellect remained clear in the midst of all of these; but the pains in the head and neck were incessant;

nutrition was insufficient on account of the dysphagia, respiration was incomplete, and the suppuration of the abscesses was copious, so that the patient succumbed on July 2, 1879.

Autopsy.—The autopsy revealed adhesion between the brain and the temporal fossa on the right side. The sphenoidal corner was torn off, but a portion of the cerebral substance adhered to the dura mater of the base of the skull. The right cerebellar lobe adhered also to the dura mater, and could be separated only by a certain amount of force. Over the upper and posterior surfaces of the petrous pyramid, there were adhesions due to chronic meningitis.

Upon removal of the brain, the dura mater covering the right half of the cavity was seen to be elevated over the region of the temporo-sphenoidal and inferior occipital fossæ, thus diminishing considerably their capacity. Their fundi were puffed and prominent, and consisted of distended dura mater, covered with false membrane. This gave to the touch a sensation of false fluctuation, and the pressure thus exerted on it caused a drop of whitish ropy fluid to exude from the openings through which the various nerves passed. The basilar groove, instead of being concave, had become almost convex; but that which diminished still more the occipital foramen was the presence in it of a bony eminence which had perforated the dura mater and which proved to be the *odontoid process.* The seventh and eighth nerves, at the point of entrance into the petrous bone, were surrounded by a ring of pachymeningitis five millimetres thick. Upon lifting the dura mater, there were detached with it two masses of a whitish, soft, fungoid substance, adherent to its outer or under substance.

The same kind of substance filled the temporo-sphenoidal and occipital fossæ on the right side, and extended even into the soft tissues of the neck. The mastoid and squamous portions of the temporal bone had been eroded by it, and had consequently disappeared. Toward the petrous part of the bone there was no distinct boundary between the fungoid mass and the remaining parts of the temporal bone. The neoplasm had infiltrated the remaining parts of the bone, the only part which had escaped being the prominence corresponding to the superior semicircular canal and a small portion of the bone adjoining it. In front, the infiltration had extended to the sphenoid, and had invaded the basilar apophysis, as far as the sella turcica, and a part of the point of the petrous pyramid on the left side. Outwardly, the neoplasm had reached the skin, and in the external layers of the new growth the abscesses mentioned had formed. The muscles of the auricle had been detached from their points of origin, and the fungoid masses at the meatus of the ear originated from the bone. Upon removing the dura mater from the occipital foramen, it was found that the atlas had entirely disappeared, and that the bony prominence in the occipital foramen was the odontoid process, which had passed through

the spinal dura mater, in consequence of a kind of luxation of the occiput on the axis. It was indeed difficult to understand why instant death had not supervened long before, in consequence of pressure on the medulla.

The superior articular surface of the axis on the left side was found in contact with the occipital condyle. On the right side, the mass of new growth in the skull merged gradually into the soft parts. The parotid gland was enlarged, and, on being incised, looked pale and lardaceous. The condyle of the inferior maxilla was roughened, and the inter-articular cartilage was gone. The lesions in the petrous bone explained the facial and auditory paralysis. The invasion of the foramen lacerum posticum explains the disturbances in the action of the spinal accessory, the pneumogastric, and the glosso-pharyngeal; and the destruction of the atlas accounts for the great precautions of the patient in holding his head and moving his neck.

The microscope revealed typical cancer-cells.

Traumatic and Inflammatory Affections of the Middle Ear. Dr. K. Bürkner: *Archiv für Ohrenheilkunde*, Vol. XV., p. 219.—The first of the two cases, whose histories form the subject-matter of Bürkner's article, was of traumatic origin. The patient, a coachman, twenty-seven years of age, received a box on the left ear, of such violence that he fell to the ground unconscious, and did not regain his senses for about two hours. When he came to himself he became conscious of an incessant roaring in the left ear, and soon discovered also that his hearing was defective in that ear. Whenever he moved his head toward the right side, he experienced a sharp pain in the affected ear. Any sudden jarring of the body also caused pain in this ear. The gait at first was markedly staggering. Dizziness was also at that time a constant symptom, and whenever the patient closed his right ear, for the purpose of testing the hearing of the left, this dizziness became much worse. During the first three days the patient kept his room, and experienced no special discomfort so long as he remained quiet. On the 3d of January, 1879, the fourth day after the patient had received the blow, Dr. Bürkner saw him for the first time. The man's face was decidedly flushed, and his gait was still unsteady. The deafness, tinnitus, dizziness, and pain were also still present; the latter, however, in diminished degree. The hearing, for the watch, was reduced to 20 centimetres ($\frac{20}{150}$); for whispered words, to 2 metres. The tuning-fork was heard, through the cranial bones, much better in the left ear. The drum-membrane of this side presented a normal surface, but was markedly sunken, and through it the long process of the anvil could easily be seen. There were no ecchymoses or other evidences of violence. Even gentle inflation of the middle ear by means of a catheter caused the patient so much pain that Dr. B. was obliged to desist from it. The entrance of air into the tympanum was accompanied by quite loud snapping noises,

which followed each other in quick succession (about four times in a second), and could be heard at quite a distance from the patient. These noises, Bürkner says, were undoubtedly due to a reflex cramp of the tensor tympani muscle.

[It is difficult to comprehend how a spasmodic contraction of the tensor tympani muscle could, by any possibility, produce a sound of such loudness that others besides the operator might easily hear it, unless the drum-membrane, at the time, was in a parchment-like condition. As the account, however, clearly states that the membrana tympani presented a normal external surface, and that the long process of the anvil was easily seen through it, we are justified in assuming that no such parchment-like stiffening and thickening of the membrane existed, and that, consequently, no sudden change in the position of its movable central portion could give rise to any such noise as that heard by Dr. Bürkner. Loud objective noises in the ear, such as those observed in the present case, may be safely attributed to one of the following three causes: first, the escape, *staccato*, of compressed air from the middle ear through the Eustachian tube; second, the bursting of large bubbles of air in a tympanum containing both air and fluid; and third (probably the most frequent cause), the spasmodic separation of the moist lips of the pharyngeal end of the Eustachian tube.—*Reviewer.*]

The inflations afforded marked relief of all the unpleasant symptoms. The tinnitus decreased, the hearing improved, and the pain caused by the movements of the head became insignificant.

On the 6th of January the patient was seen again. The hearing had still further improved, the dizziness only troubled him occasionally, and the drum-membrane was decidedly less sunken than when first examined. Inflation by means of the catheter produced precisely the same snapping noises as when this procedure was carried out at the previous visit.

On the 8th of January the hearing for the watch had increased to $\frac{100}{150}$; the tinnitus and sensations of pain had entirely disappeared; there was no longer any dizziness, and the drum-membrane appeared to be perfectly normal. Occasionally the patient still experienced some twitching in the affected ear.

In his comments on this case, Bürkner expresses the opinion that the severe symptoms were undoubtedly due to the pressure brought to bear from without upon the membrana tympani and ossicles. He believes that the force of this inward pressure was such as to greatly stretch and perhaps tear the membranous structures which surround the foot-plate of the stirrup. He is not disposed to believe, however, that the labyrinth was primarily injured.

In the second case reported by Bürkner, the patient, a servant girl, twenty-five years of age, five months advanced in pregnancy, and a short time previously under Prof. Ebstein's care for a chronic articular rheumatism, suddenly

became very deaf in the left ear. A loud roaring noise and sharp pain accompanied the deafness. Eight years previously she had passed through an attack of typhoid fever, which was followed by a purulent inflammation of the right middle ear, and this in turn by the total loss of the power of hearing on that side.

Dr. Bürkner did not see the patient until four days after the acute affection of the left ear had begun. She then (May 19, 1879) presented every appearance of a person who was very ill. Her face was very much flushed; she could only understand what was said to her when the words were spoken in quite a loud tone of voice directly into the left ear; and the slightest pressure in the neighborhood of the left ear caused her pain. On examination with the speculum and reflected light, a bluish-red, bulging membrana tympani was seen. Anteriorly and inferiorly a narrow strip of comparatively healthy drum-membrane could still be distinguished. Irregularly shaped whitish spots (epithelium) were scattered over the dark surface of the rounded mass. From the appearances presented there could be no reasonable doubt that an extensive extravasation of blood (hæmatoma) had taken place into the tissues of the membrana tympani. Inflation by Politzer's method caused a moderate degree of improvement in the hearing.

On the 21st of May no appreciable change was found to have taken place in the condition of the ear. The pain had diminished, but the roaring and the difficulty of hearing were the same as before.

On the 22d of May a clear, watery discharge appeared in the left ear, and soon became distinctly purulent. A perforation sound was heard during inflation, but, on inspection, no opening could be seen in the membrane, which still presented a bulging, bluish-red appearance; the surface of the bulging portion being somewhat irregular.

From this time forward the pain steadily diminished, the bulging subsided, the discharge grew less and less, and on the 7th of June the perforation was found to have healed. Posteriorly and inferiorly there was still some redness, but otherwise the drum-membrane appeared to be normal. The patient also expressed herself as being free from any uncomfortable sensations in the ear.

In commenting upon this case Bürkner says that the points which favored the diagnosis of hæmatoma of the membrana tympani, were, first, the irregularity of the bulging outer surface of the drum-membrane, and, second, the fact that a clear fluid escaped from the ear at a time when the membrana tympani still contained blood in the form of an extravasation. If the case had been one of hæmo-tympanum, the surface of the membrane would have been smoothly rounded, and inflation of the middle ear would have changed the appearance of the membrane, as seen from the auditory canal.

Bürkner's chief object, as he tells us, in reporting this case, is to call attention to its etiology. At first he was disposed to look upon the hemorrhage as

the result of embolism. Its sudden development and the co-existence of articular rheumatism favored such a belief. No heart-murmurs, it was true, had ever been discovered; but still the lesions in this organ may have been so light as to escape detection by auscultation, and yet have been amply sufficient to supply the material for an embolus. This idea was abandoned, and in its place Bürkner thought himself justified in adopting the view that a thrombosis of the veins of the middle ear, dependent upon the condition of pregnancy, had given rise to the exudation in the middle ear, to the hemorrhage into the tissues of the membrana tympani, and to the purulent process which followed.

[Bürkner dismisses the idea that a simple cold may have been the cause of the entire series of pathological changes described above, with the mere statement that "the patient, who was then an inmate of the hospital, had not been exposed to cold, or to any other harmful influences." When cases precisely like the one here described are known to follow what is usually termed a "cold," it seems more natural to choose this as the probable etiological factor, instead of adopting as a cause a process about which we know so exceedingly little, at least in the domain of the ear. To apply the term thrombosis to the vascular changes which may accompany any acute inflammation of the middle ear, is simply to produce a hopeless state of confusion in the minds of most medical men.—*Reviewer.*]

Cases of Disease of the Labyrinth. Dr. Louis Blau: *Archiv für Ohrenheilkunde*, xv. Bd., No. 4, p. 225.—The first case is that of a young man, twenty years of age, who had never before experienced the slightest difficulty of hearing, or any other symptom referable to the ears. On the 31st of March, 1879, immediately after firing his gun, he noticed a dull, heavy sensation, and a loud singing noise in his left ear. The latter symptom had continued, without remission, up to the time when Dr. Blau first saw him, viz., on the 3d of April. He had also experienced a certain degree of deafness in the affected ear, but no pain nor any dizziness. No escape of blood from the meatus had been observed. During the first few days there were certain peculiar disturbances of the hearing. Thus, for example, on the very day of the accident, he noticed that *sch* sounded to him like *sz*. This symptom, however, had already disappeared on the second day. Furthermore, during the first few days, he noticed that whenever anything was said to him in an ordinary tone of voice, or whenever he himself spoke, the words resounded in the affected ear with a peculiar metallic quality. This symptom caused him the most distress, however, when he listened to instrumental and vocal music, as he did on the very evening of the day on which the accident occurred.

On the 3d of April Dr. Blau examined the patient's ears and found them in the following condition: The right ear seemed to be in every respect normal. On the left side the watch was heard at a distance of 20 centimetres ($\frac{2}{16}$),

but the ticking sounded more muffled than on the right side, and its clang tint also seemed to be different. When it was pressed against the left mastoid process, the ticking was heard only faintly, more faintly than when it was similarly pressed against the right one. The vibrating tuning-fork, when placed upon the head, or pressed against the teeth, was heard by the patient in the centre of the head: when the left ear was closed, however, the vibrations were heard better in that ear. On testing the patient with tuning-forks of different pitch, and with the tones of the piano, it was ascertained that no difference existed between the two ears with regard to their power of distinguishing tones of different height. The left membrana tympani was slightly opaque, without any evidences of a rupture or even of congestion. Posteriorly, the long process of the anvil could be seen through the membrane. No râles were heard during inflation of the middle ear, but the posterior and superior quadrant was found to be in a bulging condition immediately after the inflation.

On the 5th of April the patient was seen a second time. The ringing noises still continued, and no change had taken place in the hearing. The peculiar phenomena of resonance, however, had almost entirely disappeared. It was only when a musical tone was produced that he still noticed the persistence of this symptom. Iodide of potassium was prescribed internally.

The ringing noises gradually diminished, and by the 11th of April they were not more than half as intense as they had been at first. Then followed a period of a month, in which little or no improvement took place. Various plans of treatment were tried in succession: hypodermic injections of nitrate of strychnia, galvanism, the administration of the bromide of potassium internally, and, finally, local bloodletting by means of Heurteloup's artificial leech. These measures, however, all failed to afford material relief. In September, when the patient was last seen by the doctor, the tinnitus was still present, and the unpleasant phenomena of resonance continued to recur whenever he heard vocal or instrumental music.

Dr. Blau considers this case as an instance of simple *concussion of the contents of the labyrinth.* He believes that if actual hemorrhage had taken place in this cavity, the symptoms observed would not have reached their maximum intensity at once, as actually happened, but would have gradually though perceptibly increased for a short time after the accident. In the next place, hemorrhages in these parts are apt to cause more serious disturbances than those observed in the present case; or the perception of sound, with regard to a certain series of tones, is destroyed, which implies a hemorrhage of well defined limits, in a particular portion of the labyrinth. Dr. B. also calls attention to the fact that, notwithstanding the pure labyrinthine character of the affection, the tuning-fork was always heard in the middle of the head, and never more distinctly in the right or sound ear than in the left. Finally, the failure of the

"constant current" to afford any relief in the present case leads the doctor to remark that, with a single exception, he has never succeeded in accomplishing any perceptible good in cases of tinnitus, or other subjective ear symptoms, by means of electrical treatment. In the exceptional case alluded to, the apparent improvement lasted only a few days. (A detailed history of this case is then given.)

The second case reported in this article is also one of probable concussion of the labyrinth. It presents no features of special interest, and further mention of it does not appear to be necessary.

The third case is considered by Dr. Blau as one of *hemorrhage into the inner ear*. The patient, a locksmith, twenty-seven years of age, had, when eight years old, entirely lost the hearing of his right ear, in consequence of an attack of measles. All efforts to restore the hearing had proved of no avail. So far as the left ear was concerned, the patient was quite positive that the hearing had always been quite good in that ear. On the day before he visited Dr. Blau he miscalculated the height of a low doorway, and struck his head violently against the top of it. He at once experienced a loud rumbling or roaring noise in the bead, and during the next two hours he gradually passed into a condition of total deafness. A ringing noise, such as might come from a bell of high pitch, was also noticed by the patient in the left ear. No headache or nausea followed the accident, and the patient experienced no pain or discharge from the ear. On the following day, Sept. 13, 1879, Dr. Blau saw him, and observed that he walked with a very uncertain step, very much as if he had been drinking to excess. Questions put to him in a loud tone were understood at times, but it was not clear whether he actually heard the words spoken, or simply made them out by watching the speaker's lips. Words spoken loudly into the patient's left ear caused a painful sensation, and were not understood by him. He also could not distinguish the ticking of a watch, even when it was pressed against the skull. Both drum-membranes were slightly opaque, and presented a less brilliant surface than they should, but in all other respects they were essentially normal.

On the 16th of September the hearing appeared to have improved a little. The loud ringing noise, however, and the peculiar dull sensation in the left ear still continued. On the 14th he had vomited once, but since then there had been no recurrence of this symptom. His gait had also improved, though in the darkness he still experienced difficulty in this respect.

On the 21st the patient was able to understand spoken language at a short distance, provided it was uttered in a moderately loud tone of voice. He seemed to think that his hearing was then nearly as good as it had been before the accident. The left ear was tested with tuning-forks of different pitch, and with the tones of the piano, but no missing tones could be found; the patient distinguished each tone of the series readily. The ringing noise,

he said, was steadily growing feebler, and his head felt lighter and clearer. No change was made in the treatment, which consisted essentially in rest and the administration of iodide of potassium internally.

On October 5th the patient was seen by Dr. Blau for the last time. He believed that his hearing was then fully as good as it had been before the accident. The ringing noise had entirely disappeared, and he experienced no difficulty in walking steadily, even in the dark.

In commenting upon this case, Dr. Blau calls attention, first, to the untrustworthiness of patients' statements with regard to the acuteness of their hearing. He then proceeds to give the reasons which appear to him to justify the diagnosis of an escape of blood into the left labyrinth, due to the blow which the patient had received upon the top of his head. First among these he mentions the gradual development of the symptoms—the deafness and the ringing noise in the left ear—which did not attain their full intensity until after the lapse of about two hours; second, the normal condition of the middle ear and the brain, so far, at least, as could be inferred from a careful examination of the parts, and from the absence of all brain-symptoms. Finally, he calls attention to the great difficulty which the patient experienced in maintaining his equilibrium. At first he could scarcely walk or even stand without losing his balance: later, his gait during the daytime became quite steady, but it was a long time before he could walk, without staggering, in the dark. These symptoms, Dr. Blau thinks, were clearly due to a lesion in the semicircular canals.

In the fourth case reported by Dr. Blau the feature of greatest interest was the development of double hearing in the course of an otitis media purulenta acuta. The patient, a lawyer, twenty-six years of age, experienced severe pain in the left ear during convalescence from a mild pharyngeal diphtheria. Two days later, upon the appearance of a discharge from the ear, the pain abated. When Dr. Blau saw him for the first time, on the 13th of May, 1879, the pain had almost entirely disappeared, and the patient complained simply of a roaring noise and a sensation of weight in the left half of the head. On examination the following conditions were found: There was slight tenderness, on pressure, over the left mastoid process; the auditory canal was very much narrowed; the membrana tympani was swollen and very red, and a perforation existed in its anterior and lower quadrant. Inflations by Politzer's method, painting the mastoid integuments with tincture of iodine, and cleansing the meatus, constituted the only remedial measures.

On the 23d of May the drum-membrane was found to have lost much of its redness, and the discharge had also greatly diminished in quantity. The watch was heard only when it was pressed against the auricle; it was not heard when pressed against the skull in the neighborhood. The sound of the vibrating tuning-fork, when pressed against the skull in the median line, was

heard by the patient only in the left ear. Tuning-forks of different pitch were heard more than half a tone lower in the left than in the right ear. The same difference between the two ears was observed when the notes of the middle octaves of the piano were sounded.

On the 26th of May the discharge ceased. The condition of double hearing still persisted, and annoyed the patient exceedingly whenever he played the piano.

On the 4th of June the interval between the notes heard in the two ears, when they were tested in succession with the same tuning-fork, was found to have diminished quite appreciably. A decided diminution in the swollen condition of the drum-membrane was also observed.

On the 21st of June the patient was seen for the last time. All unpleasant subjective sensations had disappeared, the hearing was practically normal in acuteness, and the tuning-fork produced precisely the same tone in both ears.

The author's comments upon this case contain nothing of decided importance, and therefore require no special mention in this review. The same remark applies to the three brief histories of cases with which he concludes this interesting contribution to clinical otology.

The Relation of Diseases of the Ear to Those of the Uterus. J. Baratoux: *Tribune médicale*, Nos. 590, 592, Dec., 1879; and 595, 597, Jan., 1880.—The writer claims originality in announcing that "diseases of the ear may show themselves in connection with menstruation, either at each menstrual period, or at the menopause. Again, an acute malady in the functions of the uterus may induce a sudden affection in the ear, and sometimes, certain aural diseases appear shortly after an attack of disease in the uterus, so that we are enabled to say that if the uterine disease is not the exciting cause of the aural lesion, it is at least a determining cause of the latter."

1. *Disturbances in Hearing arising at Puberty.*—In such cases there are generally seen the following symptoms: A child, heretofore affected with a running from the ear, which, however, has ceased for some time, arrives at the age of puberty. There then arises a marked aggravation of the aural symptoms. Sometimes there are tinnitus and roarings; sometimes only an increase in hardness of hearing, or it may be a renewal of the discharge from the ear already diseased. Sometimes the ear, which has hitherto been well, takes on the morbid process, under the congestive influence which has again affected the already diseased ear. The mucous membrane (for from this the phenomena generally arise) becomes congested, inflamed, and sooner or later pus escapes through a spontaneous perforation in the drum-membrane, or through an old perforation in the membrane; in illustration of which, notes of three cases are given, but which we think fail to prove any specific connection between the period of puberty and the aural disease. At most there is shown

only that a first menstruation may aggravate an old aural disease as much as, no more than, a cold in a lad might affect his diseased ear.

2. The next class of cases consists in aural diseases, which reappear periodically at each menstrual epoch, and here the writer endeavors to determine the pathological relations which connect these maladies with the physiological uterine function. Among the symptoms chiefly noted at such a time are noises in the ear which manifest themselves two or three days before the menses and which cease as soon as the menstrual function is established. In some cases hardness of hearing and deafness come on during the menses. At other times more serious diseases may appear, as earache preceding a purulent discharge, more or less copious, all of which disappear as soon as the uterine hemorrhage is established, though sometimes the pain in the ear persists after the menses. The writer holds that these symptoms could not appear constantly by chance. In some cases there regularly appeared with each catamenial period a train of symptoms consisting in tinnitus aurium, deafness, earache, and otorrhœa. It must be borne in mind, however, that as is stated by M. Baratoux, in this class all the patients were lymphatic or scrofulous, which tends to show that the train of peculiar symptoms in question are found in just such individuals.

3. In a third chapter an attempt is made to show, by quoting from Triquet two cases, that there are some instances in which aural diseases, first induced at the time of the first menstruation, manifest themselves regularly afterward at each catamenial epoch. Triquet is then quoted to show that an aural hemorrhage may supplement a menstruation, or, in fact, take its place. In the first case cited to illustrate this point, the ear which exhibited this periodical bleeding was filled with granulations, which, becoming engorged at each menstrual period, furnished the hemorrhage. In another case the patient had been affected with otorrhœa since childhood. Here, too, granulations were present in the ear. After the successive destruction of the granulations in the ears aural hemorrhage ceased and an abundant uterine hemorrhage is said to have been established thereafter.

In a subsequent paper M. Baratoux will endeavor to show that the menopause may cause pathological changes in the ears.

Reports of Cases of Primary and Secondary Periostitis and Ostitis of the Mastoid Process. Dr. Jacoby: *Archiv für Ohrenheilkunde*, xv. Bd., No. 4.—This article begins with a report of three cases of primary periostitis of the mastoid process. In the first case, which was seen on the 26th of March, 1876, the patient, a man about fifty years of age and in good general health, complained of severe pain in the right mastoid region, of several days' duration. He had never before experienced any trouble with the right ear. On examination, Dr. Jacoby found decided œdematous swelling of the integ-

uments covering the right mastoid process. There was also marked tenderness on pressure. In other respects the ear seemed to be normal, and there was no fever. A free incision through the mastoid integuments, including the periosteum, was followed by quite free bleeding. The wound healed without suppuration under modified Lister's dressings. The patient was kept under observation until the 26th of April, as the skin back of the mastoid process, in the direction of the occipital protuberance, showed a tendency to remain somewhat inflamed.

The second case was seen on the 17th of May, 1876. The patient, a man about seventy-five years of age, had been for many years very deaf, but he had never had a discharge from, or an acute inflammation in the left ear. When Dr. J. first saw him there was a fairly well marked acute periostitis of the left mastoid process, associated with hyperæmia of the posterior wall of the auditory canal. Repeated local depletion by means of leeches, painting the skin over the mastoid process with tincture of iodine, prolonged application of ice to the parts, and, finally, scarification of the posterior wall of the meatus near the membrana tympani, were all tried in succession, but without much effect: the pain continued with varying intensity up to the 25th of May. A free incision, however, made on that day, afforded entire and permanent relief.

In the third case, the patient, a man thirty-six years of age, and, apart from a chronic bronchial catarrh, strong and healthy, came under Dr. Jacoby's care on the 4th of February, 1877, for an inflammation of the right middle ear, which had begun a few days previously. Paracentesis of the membrana tympani was performed on that day, and on the following 25th of March the patient was dismissed, the perforation having by that time perfectly healed. On the 11th of April he returned with a large abscess in the right mastoid region. An incision was made, the wound was dressed according to Lister's method, and on the 29th of the same month the patient was again dismissed as cured.

Next in order follow the histories of seven cases of secondary periostitis, some of which present features of decided interest, and demand a full review in these pages. As the author very rightly intimates, the fact that a large number of cases of this disease have already been reported does not render the publication of new cases superfluous. Each case may present new features, or the writer's account may furnish new suggestions, new food for thought.

The first of the seven cases alluded to is that of a government secretary of Breslau, twenty five years of age. He was first seen on the 6th of October, 1877, and stated that ten days previously he began to suffer from pain and deafness in the right ear, due, as he believed, to a cold caught while hunting. In a short time a mucous discharge appeared, and this, he said, had continued steadily since. On examination, Dr. J. found a moderate amount of mucopurulent secretion at the further end of the canal, and a small perforation in

the drum-membrane. There was no swelling or tenderness on pressure in the neighborhood of the ear. The watch was heard only when pressed against the auricle. The Eustachian tube, so far as could be judged by auscultation during inflation by means of the catheter, seemed to be very much contracted. During the first few days the treatment was restricted to the use of the douche and the catheter. From the third week onward, for about fourteen days, instillations of a weak solution, at first of sulphate of zinc and afterward of nitrate of silver, were employed, but without any appreciable benefit. Then, for about eight days, a weak solution of acetate of lead was used. During the second month, weak solutions of nitrate of silver were again used. On the 1st of December the patient complained for the first time of a sensation of weight in the head, and of darting pains in the mastoid region. During the night of December 2d he was kept awake for two or three hours by pain in the head. Already, some time previously, Dr. J. had observed a slight swelling of the posterior and upper wall of the osseous portion of the canal. This swelling had steadily increased until, at the time when he began to complain of pain in the head and mastoid region (Dec. 1), it had encroached upon the canal to such an extent as to conceal the greater part of the drum-membrane from view. On the 16th of December a free incision was made through this swelling; but, notwithstanding this, Dr. Jacoby found, only two days later, tenderness on pressure over the mastoid process and a moderate degree of œdematous swelling of its outer integuments. The darting pains had disappeared, but a sensation of tightness in the head still remained, and on one occasion the patient experienced an attack of vertigo of such severity that he had difficulty in maintaining his seat. On the evening of the 19th the body temperature was found to be 38.3° C. (101° F.), the pulse 115. During the afternoon the patient suffered for several hours with severe pain in the right temple and forehead; he also experienced chilly sensations. On the 20th it was observed that the swelling behind the ear, and more especially beneath the mastoid process, had increased. Evening temperature, 38.5° C. (101.4° F.); pulse, 96. Although the patient had kept his bed since the 19th, Dr. J. found on the 21st that the radiating pains in the mastoid and temporal regions had rather increased than diminished. He accordingly decided to establish an opening in the mastoid process, by means of the bone chisel and mallet. Narcosis was produced by means of chloroform, and the operation was completed without any unpleasant drawbacks. The depth of the opening in the bone was about two centimetres. No appreciable softening or other evidence of bone disease was found. The efforts made, subsequently to the operation, to syringe water from the wound into the middle ear, and out through the perforation, either failed entirely, or succeeded only in a limited degree, the water escaping drop by drop. From this time forward the patient's progress toward recovery was steady. On the 2d of January the discharge from the ear ceased. The diminution of the swelling at

the inner end of the meatus took place gradually, but on the 24th of March, when the patient was seen for the last time, the calibre of the canal had returned to its normal proportions, and the external wound had healed perfectly. The diminution in the hearing power was too slight to be appreciated, except when tested by means of the watch. A very slight tinnitus was the only subjective discomfort that remained.

In the author's very judicious comments upon this case, he calls attention to the following points: In the first place, the failure of the measures employed to arrest the progress of the disease justified the suspicion that the inflammation had extended to the periosteal or mucous lining of the mastoid cells. In the next place, the slowly developing swelling of the posterior and upper cutaneous (periosteal) wall of the osseous meatus, near the drum-membrane, confirmed this suspicion. [The tenderness and swelling of the mastoid integuments must have been considered by Dr. J. as a further confirmation of the view taken by him.] As the swelling in the canal encroached upon its calibre sufficiently to interfere with the free escape of the pus, as there was a certain amount of fever, and as the head symptoms—at no time very marked, it is true—were gradually increasing, the question presented itself, Can Wilde's incision of the mastoid integuments be trusted as a measure sufficiently powerful to arrest the disease in its further progress? or, Will it be wiser to make at once an opening in the bone? In a similar case which had come under Dr. J.'s notice, Wilde's incision failed to arrest the disease, and he therefore decided, in the present instance, not to trust to the mere external incision, but to establish at once an opening in the bone. Another consideration which influenced the doctor in his decision was the fact that it is impossible to tell, from the patient's symptoms and from the condition of the parts that can be seen, just how far the disease has progressed in the deeper parts which cannot be seen. Hence the wisdom of assuming that the disease in the unseen parts of the mastoid process has made marked progress and is threatening to extend to vital parts unless a free opening is established in the bone. The following, which is the second of Dr. Jacoby's cases of secondary periostitis of the mastoid process, affords a good illustration of the very point which has just been brought forward:

The patient, a baker, fifty-two years of age, was seen for the first time on the 16th of October, 1877. He stated that four weeks previously he experienced severe pain in the left ear, and that soon afterward a discharge appeared, which had continued ever since. He was a rather thin man, but muscular. The parts around the ear appeared to be normal. On examination, the inner end of the meatus was found to be filled with pus; a small perforation was visible in the anterior lower quadrant of the membrana tympani; the left Eustachian tube was almost closed. Under the employment of the douche and instillations of a weak solution of the subacetate of lead, the discharge ceased in about nine days, and the perforation apparently healed. On the 31st of

October, six days after the otorrhœa had ceased, the patient was seen for the third time. There was then tenderness on pressure over the mastoid process, and the patient complained of pain in the same region. The canal was found again filled with pus, and the perforation in the drum-membrane was again visible. On the 3d of November the patient reported that the pain in the mastoid region had increased. A free incision was accordingly made through the skin and periosteum of this region. During the next few days the pain steadily increased, and an abscess formed behind the mastoid process. On the 7th the abscess was opened. On the 8th the probe introduced into the wound encountered distinctly carious bone at the upper and outer portion of the process, and a little beyond this it engaged itself in a fistulous canal. The pains continued in spite of everything that was done, and in the course of a few days an abscess, as large as an apple, developed in the region of the fossa retromaxillaris. This was opened on the 21st of November. The cavity of the abscess was explored with the finger, but no communication could be detected between it and the mastoid process. No material improvement in the patient's condition immediately followed the opening of the abscess, but from this time onward the pain gradually subsided, and for three or four days previous to the 3d of December the patient remained quite free from pain. During the afternoon of that day, however, he felt wretchedly. On the 4th a swelling showed itself on the left side of the neck, just below the larynx, and increased rapidly in size. On the 5th it had reached such a size as to cause marked dyspnœa and cyanosis, by compression of the trachea and other neighboring organs. Tracheotomy was performed early that morning, but in spite of it the patient died at four o'clock in the afternoon. At the post-mortem examination no meningitis, no thrombosis of the sinus, no abscess of the brain was found. On the left side of the neck, however, as far down as the trachea, the subcutaneous cellular tissue, and that lying between the muscles, were infiltrated with a sero-purulent fluid. The submucous tissue of the trachea was also infiltrated with sero-pus. Finally, in the left spheno-palatine fossa quite a large quantity of cheesy pus was found.

In his remarks upon this very interesting case, Dr. Jacoby states it as his belief that probably the patient's life might have been saved if a free opening had been made in the mastoid process when it was discovered that the surface of the bone was carious.

As the remaining cases which are reported in this article present no features of marked interest, no further space will be given to their consideration. In his comments upon one of these cases, however, Dr. Jacoby very judiciously calls attention to the importance of using very little force in our efforts to send a current of water from the external wound into the antrum, and thence out through the perforation in the drum-membrane, into the meatus.

Contributions to the Pathology of the Internal Ear. By P. McBride, Pathological Laboratory, Edinburgh University: *Journal of Anatomy and Physiology*, Jan., 1880.—This paper possesses sufficient interest in its description to warrant reproduction in great part rather than its condensation in review form, which from the nature of the communication would require the omission of many of the details which are of interest for purposes of comparison.

I. In the first of the two cases presented the specimen was taken from a patient who died in the Royal Infirmary under the care of Prof. Grainger Stewart, who kindly allowed a dissection of the ear and a description of the case. The facts are briefly as follows:

The patient's condition pointed to an intracranial tumor, pressing upon the auditory and facial nerves among others, on the right side. The deafness had existed for a year before his admission to the hospital, and facial palsy for six months. The post-mortem examination revealed a small, round-celled sarcoma, affecting the cerebellum and petrous portion of the temporal bone, pressing upon several of the cranial nerves, and sending a process into the internal auditory meatus.

No abnormal condition existing in the tympanum, the portion of the temporal bone outside of the promontory was removed. The internal auditory canal was then split up in order to ascertain to what extent it was penetrated by the growth, which was found to stop short of its fundus. In opening the meatus auditorius internus the split was carried through the vestibule, thus separating two portions of the bone, the one of which held the cochlea while the other contained the semicircular canals. The vestibule itself, as far as could be judged by the naked eye, was normal. Each portion of bone was then reduced in size as much as was compatible with the safety of the structures in its interior, prepared for histological examination, and finally cut into sections.

When those of the cochlea were examined, as they floated in water, part of the lumen of the cochlear tube was seen to be filled by a faintly yellow substance.

Microscopical examinations of the sections under low power (× 50 diameters) showed that the foreign body before mentioned occupied a considerable part of the scala vestibuli, in some even three-quarters of its lumen. Under this magnifying power it seemed to be composed of delicate straight fibres, interlacing in various directions, and inclosing in their meshes small cellular bodies.

The great bulk of material lay in the part of the scala away from the membrane of Reissner, but in some specimens that membrane itself was seen to be thickened and infiltrated with the same fibrillar structure. Certain spaces of the modiolus lying near the lamina spiralis ossea were also seen to be filled with the same delicate substance. In the scala tympani in most preparations a

small quantity of granular-looking matter was found, generally lying on or very near the periosteum, but differing altogether from that found in the scala vestibuli. Under a higher magnifying power, the foreign matter in the scala vestibuli, membrane of Reissner, and bony spaces of the modiolus, was seen to consist of delicate transparent fibres interlacing for the most part at acute angles. Most of these fibres were straight (although one or two were slightly curved) and presented the appearance of a transparent centre bounded by two darker lines.

At some parts they were more numerous than at others, and then they combined to form a stellate appearance. Entangled in the meshes of this network we can see some leucocytes, the interior of which is granular, and in some cases show vacuoles. In all respects the microscopic appearances correspond to those of fibrinous lymph, as seen in acute inflammatory affections of other organs.

The material above mentioned as lying in the scala tympani, when viewed with the high power, is only seen to be more coarsely granular than before, but no light is thrown on its origin. It may possibly be degenerated fibrin.

The periosteum of both scalæ (more especially the scala vestibuli) is much thickened, infiltrated with fibrin and leucocytes, and traversed by numerous dilated vessels, which are visible even under the low power. In some places it is loosened from the bone, and in most parts its epithelial lining seems to have been lost. The spiral ligament, too, in several specimens was seen to contain dilated and tortuous vessels and to be loosened from its bony attachment. This hyperæmic condition was also present in the bone surrounding the cochlea and in the modiolus. In the latter situation, especially, sections of large vessels were seen, contained in bony spaces and surrounded by exuded leucocytes. The bone in the neighborhood of the cochlea showed distinct signs of sarcomatous infiltration. In some preparations large masses of small round cells were found in the bone. These cells, when compared with cells from the original tumor, were seen to be identical in structure. The sarcomatous infiltration, in all probability, occurred through the cochlear branch of the internal auditory artery.

When we consider the extensive changes which had taken place in the other parts of the cochlea, it is surprising to find how little the parts contained in the cochlear duct suffered.

By a study of two or three of the best sections a very perfect picture of the organ of Corti and its adjacent parts could be obtained. The membrana tectoria was seen floating freely from its attachment to the vestibular lip of the crista spiralis, and displaying its characteristic delicately striated structure. The latter (crista spiralis), too, was well preserved, and those curious bodies, called the auditory teeth by Huschke, could be seen. They are shaped like the incisors of a rabbit, and are said by Hensen to be modified epithelial

cells. The junction of the external and internal pillars of Corti could be distinctly seen, and one or two hair-cells were also visible. The membrana reticularis, too, could be distinguished.

The semicircular canals were examined, but not a trace of fibrin could be found in them. Possibly, in this case, the deafness was at first due to inflammation of the cochlea, and not to direct pressure on the auditory nerve; otherwise it is difficult to account for the long interval that elapsed between the onset of the deafness and that of the facial palsy. Should this view be correct, it is possible that a sarcomatous tumor, not directly involving the auditory nerve, might, by extension along the internal auditory artery, set up a cochleitis, and with it, of course, complete nervous deafness, as indicated by the tuning-fork, but without facial palsy.

Burnett, in his treatise on the ear (p. 586), gives an account of the examination of the internal ear in a case of cerebral tumor, not unlike the one here described. He, too, found a foreign substance in the scalæ, but, unfortunately, minute details of its microscopic structure are not given.

II. *An Abnormal Condition of the Semicircular Canals.*—The changes in the semicircular canals, about to be described, occurred in the case of a patient (an adult) who died of acute rheumatism, and while taking the salicylate of soda. Deafness and ringing in the ears came on while this remedy was being administered, and the internal ear of one side was examined to ascertain if this drug produces deafness through producing an organic change in the labyrinth. The method of examination was conducted in the same way as in the previous case.

Microscopic sections of the cochlea revealed no deviation from the normal, but sections of the semicircular canals showed a state of things quite different from that usually found, a condition, however, which could not have been due to the salicylate of soda.

The normal appearance of a section through a bony and membranous canal, which is also oval in shape, but the lumen of which is very much smaller than that of its containing bony tube, is as follows:—This membranous canal is held *in situ* by the ligaments of the semicircular canals, which, roughly speaking, fill up the angles formed by the divergence of the membranous and bony tubes. By far the greater portion of the lumen of the osseous canal is seen to be empty, but traversed by one or two bundles of connective tissue which support blood-vessels. The walls of the membranous canal itself consist of four layers: (1) an outer layer of connective tissue; (2) a homogeneous layer; (3) a layer of papillæ, which, however, are not present on all parts of the canal; (4) a layer of epithelium, lining the canal. This is the description given by Rüdinger of the anatomy of the parts under consideration, and the main points of it have been verified from preparations in the possession of Mr. McBride.

The specimen under consideration, however, presented a very different state of things. On examining one of the sections with the low power, the shape of the osseous canal was found to be not oval, but to present an angle at one point. Inside of this was the membranous canal, having at some points well-marked papillæ. The membranous tube was, however, at no part in direct contact with the periosteum, though much nearer at some points than at others. Stretching between the outer layer of the membranous canal and the periosteum, lining its bony cavity at all parts, was a delicate recticular tissue, traversed here and there by coarser fibrous bands, and at parts showing cut vessels. Examination with the high power revealed that the tissue filling up the perilymphatic space was composed of bundles of fibres of various thickness, starting from the outer (connective-tissue) layer of the membranous canal on the one hand, and from the periosteum of the osseous wall on the other, and interlacing in all directions. On and alongside of the bundles were seen connective-tissue nuclei. In some parts the different layers of the membranous canal are beautifully seen. The outer connective-tissue layer is seen containing many nuclei; at one part the homogeneous layer is very distinct, and inside of that again are the papillæ. On one of these rounded papillæ are seen three nuclear bodies. In all probability these are the nuclei of epithelial cells, the outline of which cannot be distinguished.

In the embryo, according to Rüdinger, the whole of the space between the membranous and bony canals is filled with myxomatous tissue, and from this are developed the ligaments of the canals and the fibrous support of the blood-vessels. In this case, probably, the abnormal condition depended upon a very much larger quantity of this myxomatous matter becoming organized into fibrous tissue than is usually the case. In the rat the space is normally filled with reticular tissue.

At a meeting of the Medico-Chirurgical Society of Edinburgh—*Edinburgh Med. Journal*, November, 1879—Dr. Kirk Duncanson showed the left temporal bone of a patient who had been attending the Ear Dispensary. The man was aged 37; he had had a recent attack of acute inflammation of the left ear, accompanied with swelling and reduess of the left mastoid. A purulent discharge was found to come from an opening in the posterior wall of the meatus, about one-fourth of an inch in front of the membrana tympani, and pressure over the mastoid caused the matter to escape more freely. The patient had a haggard and anxious expression. Although the swelling disappeared quite soon, his general health did not improve; it was, therefore, decided to cut down upon and into the mastoid process. The patient, however, did not return, and it was learned that he had died. The post-mortem revealed the preseuce of pus in the arachnoid space all over the brain. The dura mater was healthy, but the upper anterior surface of the petrous portion of the temporal bone was carious.

Dr. Thomas Barr, at a meeting of the Glasgow Pathological Society, October 28th—*The British Medical Journal*, November 8th, 1879—exhibited the left temporal bone of a young man, aged 17, who died after a fortnight's illness. An aural discharge had existed for two years, and during the last ten days of life he had suffered from vomiting, pain in the head, stupor, tremors, and convulsions. The membrana tympani was absent and a polypus occupied the drum. Dr. Coats found the left temporo-sphenoidal lobe of the brain adherent to the bone beneath, with its convolutions flattened and partially obliterated. Section of this lobe showed the brain substance to be pulpy, and in its interior was found an abscess containing dirty greenish decomposing pus, which was very fetid. The abscess was lined by a soft bluish layer. Over the temporal bone the dura mater was adherent, of a blue color, and at one place an opening into the petrous bone existed. There were two carious openings of considerable size in the bone; one was in the roof of the tympanum; the other, in the groove for the lateral sinus, communicated with the mastoid cells.

On Certain Pathological States of the Tympanum which induce Nervous Phenomena, attributed, by Flourens and Goltz, exclusively to the Semicircular Canals. By M. Bonnafont: *Annales des Maladies de l'Oreille*, etc., December, 1879.—Bonnafont holds that the membrana tympani, besides certain slight lateral movements, undergoes two principal ones, the one drawing it inward toward the inner tympanic wall, and the other drawing it away. With these movements of the drum-membrane the auditory ossicles must participate, as every one knows, though, of course, the outward movement of the drum-head cannot have the same force on the ossicles as an inward movement would have, on account of the unlocking of the malleo-incudal joint, as shown by Helmholtz, a fact to which Bonnafont does not seem to have given due weight. Whenever the base of the stirrup is drawn outward, the cavity of the vestibule is augmented by as much space as this outward movement of the bone makes, and this brings about a movement in the vestibular fluid which is of course felt by the semicircular canals. The liquid in the latter obeying the law of gravity, falls to the lowest point and leaves in the canals a vacuum proportionate to the displacement already described.

If, on the other hand, any force, such as a cerumen-plug or a polyp, pushes the drum-head inward, or if a contraction of the intrinsic muscles of the drum-cavity occur, the membrana tympani is of course pushed or drawn inward toward the inner wall of the tympanic cavity. In such a case the stirrup bone will be forced inward and a compression of the labyrinth fluid will ensue, which, of course, will be felt in the semicircular canals. And thus it is seen what Goltz means when he says, this fluid exercises an influence in the canals, either by pressure or by tension. Such, according to Bonnafont, are the two physiological conditions in the organ of hearing which may, perhaps,

explain certain nervous phenomena which Goltz endeavored to explain by the simple inclinations of the head, which by a displacement of the liquid in the canals caused it to exercise peculiar forms of pressure by the effect of gravity. But the writer of the article under review finds it hard to admit that cephalic oscillations alone are able, in the normal state, to produce a displacement of the liquid in the canals, sufficient to induce the effects thus ascribed to it. For, he says, were such a thing possible, the various ordinary inclinations and movements of rotation to which the head is subjected, in its numerous attitudes, would produce an almost constant vertigo.

The Use of the Nasal Douche of Weber. Victor Lange, of Copenhagen: *Annales des Maladies de l'Oreille*, December, 1879.—This article is an able defence of the most valuable instrument at the surgeon's command in the treatment of diseases of the nares and naso-pharynx. Lange thinks that an entirely unwarranted scare has arisen regarding the employment of this instrument, on account of the misfortunes of two American surgeons, and he feels that, as he has had a vast experience in the use of this instrument, he must lift up his voice in defence of it. He holds, very justly, that it is not fair to impute a fault to a method, when the improper employment of it has been the real cause of the accident.

He lays great stress on the importance of examining the nares before using the nasal douche, in order to see whether they will permit a current of water to pass freely through them; if not, the douche must not be used. Warm water must always be used in this application, in each three-fourths litre of which two teaspoonfuls of salt, or a dessertspoonful of bicarbonate of soda, must be dissolved. After the douche has been used M. Lange advises that the patient shall not blow the nose for fear of forcing the water, which always remains in the nares, further into the nasal fossæ, or into the Eustachian tubes and middle ear. He recommends that first one nostril be cleared, by holding the other one and blowing, and that the nose be simply wiped. An ordinary hard blowing of the nose, immediately after the douche, is strongly urged against. In cases where the nostrils are of decidedly unequal width, the current from the douche is to be passed through the narrower passage and allowed to flow from the wider, for very manifest reasons.

The vessel containing the fluid is to be placed about 65 centimetres above a table on which a recipient for the water stands. The siphon principle is then put into operation and the nose-piece put firmly into one nostril. The patient should half incline his head forward; here many propositions, as to position of the head, have been recommended, but the one just named seems to be the best.

Remedial solutions of zinc, alum, and tannin, as well as of corrosive sublimate, may be employed in the nasal douche, the first *three* in the proportion

1:1,000. Though some physicians go as high as 2:1,000, the solutions of this strength are very likely to provoke a burning in the nose, and headache. Corrosive sublimate is to be used, according to the writer, as follows: Dissolve 15 to 20 centigrammes of this drug in 100 grammes of distilled water, and of this solution place a teaspoonful in a litre of tepid salt-water. As disinfectants, salicylic acid, in the proportion of 1:500 of water, and permanganate of potash may be employed by dissolving a gramme in 200 grammes of distilled water, and placing a teaspoonful of this solution in a litre of tepid salt-water.

The use of this instrument is contraindicated whenever there is any obstruction to the free current of water in the nostrils.

This may occur as a general or a partial swelling of the mucous membrane, or in the form of tumors, chief among which are polyps. In fact, any form of tumors, or of narrowing of the nares by exostoses, and it appears that small ones are not rare, renders the use of the douche impossible. Abnormal communications between the nasal fossæ and the mouth do not constitute a contra-indication; but they may render the employment of the nasal douche very difficult, and, if the perforations are too large, it may become impossible. As far as the treatment of acute coryza is concerned, by means of the nasal douche, no special influence can be attributed. If patients find the use of the nasal douche uncomfortable, during an acute coryza, they must desist until their acute symptoms have disappeared. The douche may be used in general once or twice daily, while in other cases it should be used more frequently, and its employment usually may be kept up for several months. In fact, it may be used for years, provided that no medicinal substances are dissolved in the water. In such cases it is used as a cleanser simply, and may contain the table-salt or the bicarbonate of soda, in solutions as given above.

Mr. Hulke—*Lancet*, September 22, 1879—reports five cases of fracture of the base of the skull occurring in the Middlesex Hospital, in all of which there were aural symptoms.

The first case was a boy, six years old, who fell from a window, upon the street pavement, a distance of twenty-four feet. Soon after the accident, blood was observed to be trickling from the left ear, and this was replaced by a serous fluid which ceased on the second day. In about five weeks he was discharged convalescent.

In the second case a laborer fell a distance of forty feet; blood escaped from the right ear and nose. He died on the eleventh day from a chest complication.

The third case occurred in a school-boy while at play: he fell, striking his chin on the ground. He was stunned, but soon regained consciousness. Shortly afterward blood was found trickling from the external meatus of

each ear, and continued for five days. The injury, in this case, was thought to be due to the impact of the condyles of the mandible on the floor of the tympanum causing fracture of the membrana tympani.

It is a recognized axiom that in injuries of the head, bleeding from the ear is not strong evidence of fracture of the base of the skull, unless it is copious and prolonged; in this instance the injury was thought to be due simply to injury of the tympanic membrane. The patient was discharged at the end of three weeks.

Case four was an extensive fracture of the base of the skull by a fall upon the street pavement. There was bleeding from the right auditory meatus, which, on the second day, was replaced by a serous discharge. Deafness was observed to exist in the affected ear. On the fourth day bright red blood spouted from the right ear to the amount of about two ounces. The bleeding ceased spontaneously, and the serous discharge did not recur; the patient, however, died on the fourth day. The diagnosis of extensive fracture of the base was confirmed at the necropsy.

In the fifth case a fall off two steps on the back of the head was followed by profuse bleeding from the left ear. After several hours the bleeding was replaced by a serous oozing, which, on the second day ceased. He complained of deafness in the left ear. About two weeks after the accident an examination showed there was a laceration of the membrana tympani. The patient is believed to have gone to work in three weeks after the accident, as he did not return to the hospital subsequently.

Dr. James Russell—*The British Medical Journal*, Dec. 13, 1879—reports a case of vertigo, followed by incessant sneezing for two days, from the presence of a collection of cerumen in the left ear. On the removal of the cerumen recovery took place.

The Lancet of Feb. 21, 1880, contains a paper by Mr. Dalby, who deprecates the practice of syringing, in cases of acute purulent inflammation of the middle ear, with astringent lotions; those composed of a solution of sulphate of zinc, or acetate of lead are mentioned as being in common use for this purpose. This attempt at checking the discharge has the effect of cicatrizing the edge of the perforation, and thus prevents healing. The perforations in children's ears in acute purulent inflammation are, if allowed to remain without treatment, more likely to close than if subjected to syringing with astringents.

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ORIGINAL COMMUNICATIONS.

EXPERIMENTS RELATING TO BINAURAL AUDITION.

By ALEXANDER GRAHAM BELL.

(A paper read before the American Association for the Advancement of Science, at Saratoga, August, 1879.)

When we close one ear and listen to sounds through the medium of the other, we can distinguish the pitch, loudness, and quality of such sounds, and yet there is a feeling of incompleteness about our sensations that cannot well be described. There seems to be a one-sidedness about sounds received through a single ear, as there is about objects perceived by one eye. When both ears are employed simultaneously, a sort of stereoscopic effect of audition is perceived. Sounds assume a "solidity" (if I may use the expression) which was not perceptible so long as one ear alone was employed.

The difference between monaural and binaural audition is especially well marked when we attempt to decide by ear the locality of a particular sound.

Whatever power a single ear may possess of determining the direction of a source of sound, both ears together are certainly much more effective for this purpose.

It occurred to me last year, while in England, that the stereophonic phenomena of binaural audition might be produced arti-

ficially by the telephone, in like manner as the peculiarities of binocular vision are produced by the stereoscope.

For the purpose of testing this idea, four telephones were arranged as in Fig. 1. The telephones A, B were in one room, and the telephones C, D in another. The mouth-pieces of A and B (like the auricles of a person's ears) were turned away from one another, and the instruments were so arranged that the diaphragms were about as far apart as the drum-membranes of the two ears.

The left-hand telephone A was connected in metallic circuit with the telephone C, which the listener was to place to his left ear, and the right-hand telephone B was in circuit with the right-hand telephone D.

The expectation was that a person listening at C and D simultaneously should not only hear speech from the neighborhood of the telephones A, B, but should also perceive the direction of the speaker's voice relatively to the telephones A, B, exactly as though the listener himself were in the place occupied by the telephones A, B. Mr. Warner, of Islington, assisted me in performing the experiment.

The telephones A, B (Fig. 1) were fastened to a support in the middle of the room, and Mr. Warner walked about shouting out a description of the part of the room in which he happened to be at the moment. I held the telephones C and D to my left and right ears respectively, and, from my knowledge of the other room, I could compare the sensations received by telephone with those that would have been experienced had I personally been in the place occupied by the telephones A, B.

The sensations produced were decidedly novel, but were not exactly what had been anticipated. The direction of the speaker's voice could be perceived to a limited extent, but the effect was different from that experienced by direct audition.

When Mr. Warner walked around the telephones A, B, describing a circle E F G H E, it seemed to the observer at C, D as if he had walked along the path E F G, and had then retraced his steps along G F E.

The experiments were varied by ringing a loud dinner-bell in different parts of the room near A, B, while the observer at C, D attempted by ear to determine the location of the sound.

The general results of the experiments may be noted :—

Imagine yourself to be looking down upon a globe E F G H (Fig. 1), in the interior of which are the telephones A, B. Let the usual meridian lines and parallels of latitude be imagined upon the surface of the globe, and let the points E, G be the two poles. Upon this construction F and H become two points upon the equator.

Now, suppose we produce a sound at some point in the neighborhood of the telephones A, B, we can take its bearings upon the surface of our globe; that is, we can determine the latitude and longitude of the sound.

It was found, as the final result of our experiments, that *the observer at* C, D *could determine with tolerable accuracy the latitude of a sound made near* A, B, *but that he had no idea whatever of its longitude.*

The effect produced by moving the source of sound from one place to another emphasized this conclusion in an unmistakable manner. For instance, let the source of sound be moved round the telephones A, B, following one of the parallels of latitude. When the observer at C, D first hears the sound he forms a mental conception of the direction from which it comes, and the sound seems to proceed steadily from that point all the time the source of sound is travelling round the telephones A, B.

On the other hand, when the source of sound is caused to move along one of the meridian lines, so as to cut successively different parallels of latitude; the listener at C, D is distinctly conscious of a change in the apparent direction of the sound; but the effect is the same whether the source of sound is moved along one meridian line or another.

If the sound be caused to move in an irregular or serpentine path—the sensation at C, D is as though the sound had been moved in a straight line—horizontally in front of the observer from left to right, or *vice versa.*

The discovery of the microphone, by Hughes, and the invention of the carbon transmitters of Berliner, Edison, and Blake, have given us instruments exceedingly sensitive to the feeblest sounds, and I had the opportunity recently of repeating the experiments described above, using, in place of the telephones A, B, two of the

ordinary battery transmitters employed by the National Bell Telephone Co.—the invention of Mr. Francis Blake, of Weston, Mass.

The two Blake transmitters were placed in the open air back to back, so that the diaphragms were parallel and about six inches from one another. The instruments were mounted upon a step-ladder, so as to be about as far from the ground as the ears of a person of average height.

A speaker walked around the transmitters at different distances, reciting continually in an ordinary conversational voice.

The receiving telephones (C, D, Fig. 1) were placed in a building from the window of which the motions of the speaker could be observed. The results obtained were similar to those described above—so far as the experiment was carried.

Mr. Samuel H. Scudder, of Cambridge, Mass., suggested that the experiments should be repeated with the diaphragms of the transmitters at an angle to one another, as he observed that in the majority of persons the outer ears projected slightly from the head, so that sounds were more readily perceived from the front than from behind.

The transmitters were then arranged so that the diaphragms made with one another an angle of 45°.

It was then found, as Mr. Scudder had anticipated, that a sound made at H (Fig. 1) produced a feebler effect than a sound of equal intensity made at F. When the speaker walked along the path G H E, the effect was the same as when he walked along G F E, excepting that the sounds were feebler in the former than in the latter case. After a few experiments the ear seemed able to distinguish in which half of the circle the speaker happened to be.

The two transmitters were not equal in power, and it is not unlikely that the sensations experienced were similar to those of a person slightly deaf in the left ear. Upon changing the places of the transmitters so that the left ear had the advantage, the effect was at first rather bewildering, but after a few experiments the ears became more accustomed to the new combination of sensations. I would suggest that the sensations experienced by deaf persons, might be studied by persons with normal hearing, by purposely using transmitters of different power, or by adopting the plan proposed by Mr. Sumner Tainter, of Watertown, of introducing

Fig. I

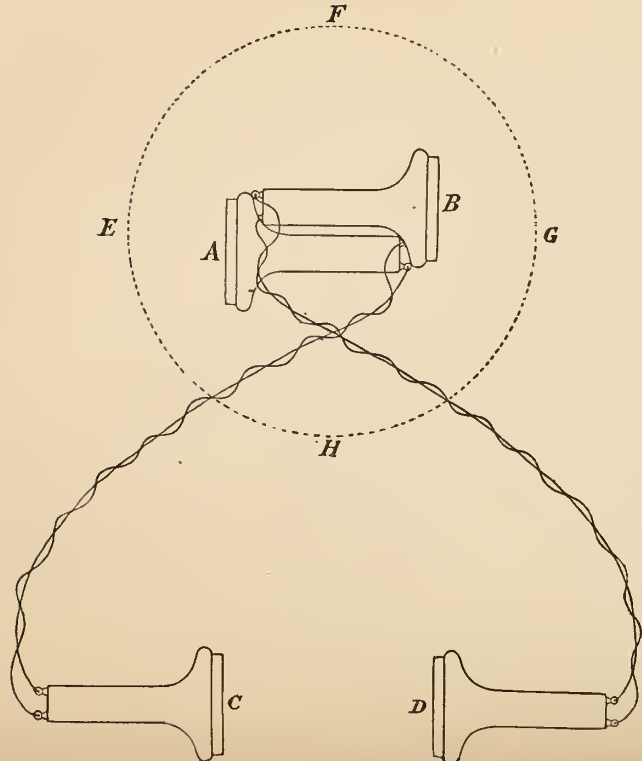
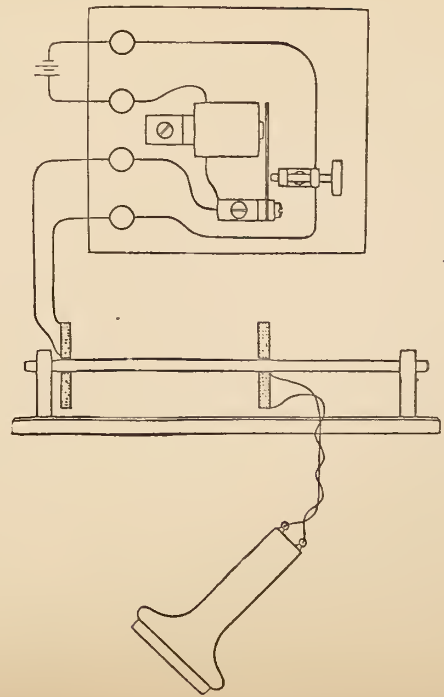


Fig. II



artificial resistance into the two telephone circuits, so that the resistances should be inversely proportional to the hearing power of the two ears of the deaf person.

It occurred to me that the telephone might afford a means of ascertaining to what degree the human ear normally has the power of appreciating direction of sound.

For this purpose a number of telephones were hung up in different parts of a summer-house, and were connected with a switch-board, so that an interrupted current from a rheotome in a distant place could be sent through any one of the telephones by suitably manipulating the switch-board. In this way a sound could be suddenly produced at different parts of the summer-house. A person stationed at the centre of the summer-house, with his eyes closed, and with directions to keep his head perfectly still, was required to indicate the point from which the sound seemed to emanate. In the majority of instances the direction indicated differed in a remarkable degree from the true direction of the source of sound. It was found that the observer soon came to recognize each individual telephone by the quality of the sound produced by it, and would finally indicate a uniform, though often mistaken direction for each telephone.

In order to avoid the bias produced by this cause, a single telephone was next used. It was hung up in different parts of the summer-house during the absence of the observer. This plan of removing the observer while the position of the telephone was being changed proved exceedingly laborious, but at the same time yielded such promising results as to induce me to undertake a long series of experiments, with the object of determining how far the ear has the power of appreciating the direction of a sound.

Prof. Isaac J. Osbun, of Salem, Mass., was kind enough to give me his assistance in conducting the experiments, the results of which are presented in the accompanying tables.

Particulars concerning the five persons whose hearing was tested are given in Table I.

The relative hearing-power of the two ears of each observer was tested by means of the arrangement shown in Fig. 2.

Two flat coils of wire were placed upon a long wooden rod which passed through their centres, as shown in the diagram.

One of these coils was fixed permanently at one extremity of the rod, and was connected by two wires to a rheotome in a distant room.

The other, or "secondary" coil, was connected with a telephone, and the distance of the secondary coil from the primary could be adjusted by sliding the secondary coil upon the wooden rod. When the secondary coil was placed in close proximity to the primary, the telephone produced a very loud, musical tone. Upon gradually sliding the secondary coil away from the primary, the sound produced by the telephone became feebler and feebler, until at a certain distance it could no longer be distinguished.

The observer was required to place the telephone to one ear, and move the secondary coil until a point of silence was reached. The distance between the two coils was then ascertained and noted. The results for the particular observers experimented upon are shown in Table II.

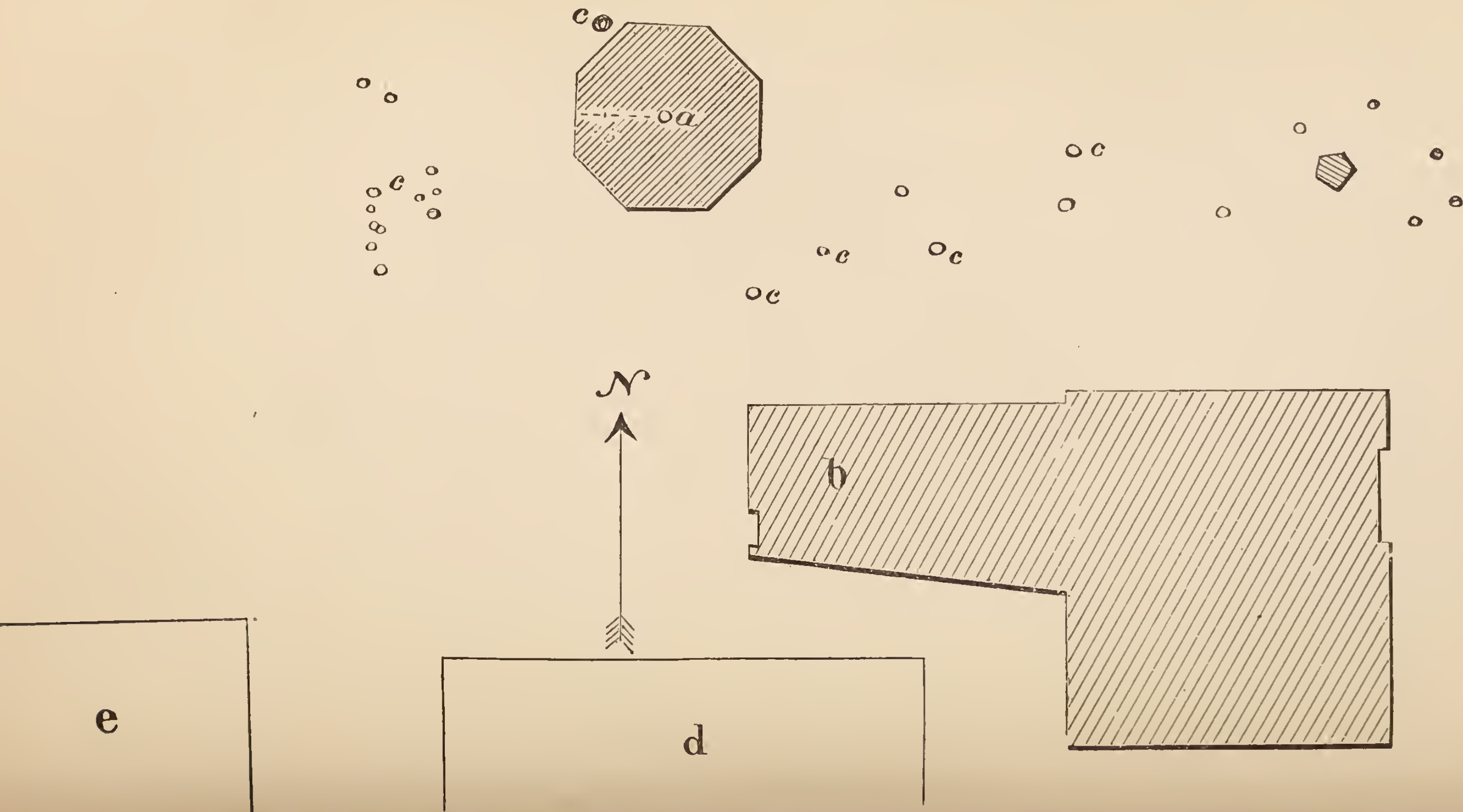
Dr. Wyman, of Cambridge, has kindly made a plan of the summer-house and its surroundings where the experiments were conducted, so that the influence of any reflecting surfaces may be investigated. This plan is shown in Fig. 3.

The summer-house (*a*) was about six metres in diameter. The walls were formed of open wood-work, consisting of straight branches of trees placed vertically. The diameter of each upright was about five centimetres, and the interspaces were considerably greater. The roof was of the same character, but the branches radiated from a central support. The buildings near the summer-house were (*b*) a barn, (*d*) a dwelling-house, and (*e*) a conservatory; and between them and the summer-house was a belt of trees and shrubbery (*c*, etc.).

Supports for telephones were fixed in the summer-house at three elevations, in each of the eight points of the compass, and also at the top and the bottom of the central post—making twenty-six positions altogether where a telephone could be suspended.

The telephone being hung in one of these positions, one of the

Fig. 3.



young men was led in blindfolded, and was placed with his back to the central post, facing in the direction of the dotted line. A rheotome had been placed in the conservatory (*e*), so that upon turning a switch, connection was made with the telephone, and a loud sound was produced.

The observer was then required to indicate the locality of the sound, and the direction in which he pointed was noted.

This process was repeated with each of the five young men who were the subjects of experiment while the telephone remained in one position.

The telephone was then shifted successively to all the positions, in irregular order, and the same mode of procedure adopted with each of the five observers.

The experiments were conducted, first, with the right ear alone open; secondly, with the left ear alone open; and subsequently with both ears open.

The results are shown in the Tables III., IV., V., VI., VII., and VIII.

The method of notation will be understood by considering the circle on the level of the two ears as the horizon, and the point of that circle cut by the dotted line in the diagram (Fig. 3.) as the zero-point of the horizon. The numbers in the tables denote horizontal distance to the right of the zero-point by plus degrees of azimuth; and to the left by minus degrees. Elevation above the horizon is indicated by plus degrees of altitude, and depression below the horizon by minus degrees.

The experiments are too few in number and too imperfect in several respects to admit of accurate generalization; but it will be seen that perception of the direction of a source of sound is less perfect by a single ear than by both ears; while the tables disprove the idea that direction cannot be appreciated by monaural observation. It will also be observed that the direction of sound is more accurately defined as it approximates to the axial line of the ears; and that the indications are proportionately at fault as the true source of sound is in any other direction. When the source is 90° from the axial line, there is often an angular error amounting to 180°. When the source of sound is at the nadir of

the observer, the perception of its direction is absolutely unreliable. This may arise from the sound being equally reflected from the ground on all sides. I have repeated the experiment a number of times upon different individuals, but have not found one who had the slightest idea of the true direction of a sound produced beneath him.

TABLE I.

Particulars concerning the Persons whose Hearing was tested.

Observer.	Name.	Residence.	Age.	Distance of ear from ground.	Remarks.
No. 1	John Kelley....	Cambridge, Mass.	14 yrs.	4ft. 5¾ inch.	All these observers had been taught singing at a public school, by Prof. Mason's method, and all seemed to possess fair musical ears. The distance of the line assumed as the horizon of the ears was five feet from the ground.
No. 2	Charles McCourt	" "	15 yrs.	4ft. 6½ inch.	
No. 3	Michael Shae...	" "	15 yrs.	4ft. 9½ inch.	
No. 4	Eugene Sullivan.	" "	17 yrs.	4ft. 11 inch.	
No. 5	Jeremiah Mack.	" "	17 yrs.	....	

TABLE II.

Relative Power of the Two Ears as determined by Telephone for the Observers alluded to in Table I.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
RIGHT EAR.					
1st determination...	24.60 cm.	19.00 cm.	26.30 cm.	30.22 cm.	18.30 cm.
2d " ...	20.10 cm.	23.70 cm.	27.20 cm.	29.50 cm.	20.00 cm.
3d " ...	22.50 cm.	24.96 cm.	23.65 cm.	28.86 cm.	20.95 cm.
Mean.............	22.40 cm.	22.55 cm.	25.72 cm.	29.52 cm.	19.75 cm.
LEFT EAR.					
1st determination...	20.13 cm.	21.46 cm.	20.10 cm.	25.72 cm.	21.30 cm.
2d " ...	19.15 cm.	21.24 cm.	21.23 cm.	28.30 cm.	20.30 cm.
3d " ...	21.21 cm.	21.60 cm.	27.53 cm.	32.30 cm.	21.50 cm.
Mean.............	20.16 cm.	21.43 cm.	22.96 cm.	28.77 cm.	21.03 c.m

TABLE III.

Direction of Sound as determined by Right Ear alone.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	0	−10	0	0	0	0
Az	0	+23	+45	+67	0	+113
Alt.	0	−10	−45	+23	−23	−23
Az	+45	+67	+90	+67	+67	+45
Alt.	0	−23	−45	+10	−23	−10
Az	+90	+67	+90	+90	+90	+90
Alt.	0	−10	−45	+23	−45	−10
Az	+135	+90	+90	+90	+90	+90
Alt.	0	0	0	+90	+90	−10
Az	±180	−45	+45	0	0	+113
Alt.	0	0	0	0	0	0
Az	−135	−135	−67	−90	−90	±180
Alt.	0	0	0	+10	+10	0
Az	−90	−90	±180	−90	−90	±180
Alt.	0	0	0	+45	0	+35
Az	−45	−23	−67	−45	−67	0
Alt.	+90	+90	+90	+90	+68	0
Az	0	0	0	0	0	±180
Alt.	−90	−68	−23	+90	−45	−23
Az	0	+113	+68	0	+113	+135

TABLE IV.

Direction of Sound as determined by Left Ear alone.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	0	0	+10	0	−10	−10
Az	0	−67	−67	−45	−23	−23
Alt.	0	0	+35	0	−10	+23
Az	+45	+23	+67	+67	+67	0
Alt.	0	0	+23	0	0	−23
Az	+90	−135	+113	−67	+157	−135
Alt.	0	0	−10	0	0	−23
Az	+135	−113	−113	−67	+135	−113
Alt.	0	0	−45	+35	+90	−23
Az	±180	−35	−35	0	0	−45
Alt.	0	−10	−10	−10	−10	−23
Az.	−135	−113	−67	−45	−45	−67
Alt.	0	−10	0	−10	−10	−10
Az	−90	−113	−67	−90	−67	−90
Alt.	0	−10	−10	−10	0	0
Az	−45	−45	−45	−45	−45	−67
Alt.	+90	−10	−45	+45	+90	0
Az	0	−90	−45	−45	0	±180
Alt.	−90	+90	0	−10	−45	−45
Az	0	0	0	−157	−135	±180

TABLE V.

Direction of Sounds produced upon the Horizon of the Ears as determined by Both Ears used simultaneously.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	0	0	0	0	−10	−35
Az	0	0	0	0	0	+10
Alt.	0	0	0	0	−45	0
Az	+45	+23	+30	+30	+67	+60
Alt.	0	0	0	−22	−45	−22
Az	+90	+90	+90	+68	+90	+45
Alt.	0	0	−10	−10	−10	0
Az	+135	+68	+113	+68	+90	+45
Alt.	0	0	0	−22	−22	−22
Az	±180	0	+45	+90	±180	+23
Alt.	0	−10	0	0	−10	−35
Az	−135	−68	−75	−90	−113	−135
Alt.	0	0	0	0	0	0
Az	−90	−90	−90	−90	−90	−90
Alt.	0	0	0	0	0	0
Az.	−45	−67	−90	−67	−90	−67

TABLE VI.

Direction of Sounds produced at an Elevation of 45° above the Horizon of the Ears, as determined by both Ears used simultaneously.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	+45	0	+22	0	+90	+45
Az	0	0	0	0	0	0
Alt.	+45	0	−10	+10	+45	+10
Az	+45	+45	+45	+45	+45	+45
Alt.	+45	0	−45		+10	−22
Az	+90	+90	+90	0+90	+68	+68
Alt.	+45	+22	+22	+22	−30	0
Az	+135	+23	+68	+60	+113	+150
Alt.	+45	0	+80	−10	+45	−45
Az	±180	0	+23	0	0	±180
Alt.	+45	0	0	+10	+10	+35
Az	−135	−68	−68	−68	−113	−120
Alt.	+45	−10	+10	0	+45	−22
Az	−90	−60	−90	−90	−90	−90
Alt.	+45	0	0	0	+45	0
Az	−45	−60	−45	−90	−45	−45

TABLE VII.

Direction of Sounds produced at Points 45° below the Horizon of the Ears, as determined by both Ears used simultaneously.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	−45	0	−10	−10	+80	−45
Az.	0	0	0	0	±180	0
Alt.	−45	0	−23	0	0	−10
Az.	+45	+45	+45	+90	+113	+45
Alt.	−45	0	−23	0	−23	−45
Az.	+90	+75	+60	+68	+90	+68
Alt.	−45	−23	0	−10	−45	−35
Az.	+135	+105	+75	+90	+120	+120
Alt.	−45	0	0	−10	−45	−45
Az.	±180	+23	±180	+128	−135	±180
Alt.	−45	−30	0	−10	−10	−23
Az.	−135	−135	−60	−105	−135	−113
Alt.	−45	−35	−23	0	−45	−45
Az.	−90	−90	−68	−90	−90	−90
Alt.	−45	−10	−45	+45	+10	0
Az.	−45	−45	−45	−68	−45	−45*

* The observer could not decide for a long time whether the sound came from a point on the horizon 45° to the left of the *zero* mark, or from one 135° to the left. The current had to be turned on a number of times before he could make up his mind as to the direction of the sound.

TABLE VIII.

Direction of Sounds produced at the Zenith and Nadir of the Observer, as determined by both Ears used simultaneously.

	True direction of sound.	Direction of sound as determined by the observers.				
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Alt.	+90	+45	+23	0	+90	+45
Az.	0	0	0	0	0	±180
Alt.	−90	0	+90	0	+90	+90
Az.	0	+22	0	0	0	0
Alt.	−90	0	−23	+10	+45	−23
Az.	0	0	−45	−23	+90	+68

THE MEMBRANA TYMPANI TELEPHONE.

By CLARENCE J. BLAKE, M.D.,

BOSTON, MASS.

The possible use of a preparation of the human membrana tympani in the construction of an apparatus for the electrical transmission of articulate speech was first suggested by the writer in October, 1874, and was a natural outcome of experiments in the use of the membrana tympani as a phonautograph and of a knowledge of the experiments then being made by Mr. Bell in the electrical transmission of musical tones. My suggestion of the use of the membrana tympani as a phonautograph had been carried out by Mr. Bell during his absence from this city in the summer of 1874, and following this and the experiments on the graphic illustration of sound-waves, which had been independently carried out during that period, came an interchange of ideas in regard to the electrical transmission of articulate sounds, many of which were had sufficiently in common to make it difficult to trace them to their individual source.

Since the object to be accomplished was the vibration, in front of an electro-magnet, of a metal reed or armature, the movement of which instead of being a simple pendulum vibration, should correspond in complex vibration to the sound-waves produced by the human voice, the attachment of the reed or armature, to a membrane which was already being utilized for the purpose of demonstrating articulate vibrations necessarily suggested itself.

Although, as stated by Mr. Bell at the time, he had already conceived the idea of attaching the metal reed or armature to some form of membrane, the suggestion of using the membrana tympani for this purpose was not adopted in consequence of the paucity of material and the question as to whether this structure

would from its small size and its delicacy answer the purposes of practical experiment.

This experiment, therefore, was not carried out until 1878, by which time Mr. Bell, after experimenting with plane membranes having attached armatures, had finally adopted the combination of armature and membrane in the iron disk, and the speaking telephone had become an accomplished fact.

For the purpose of the experiment, two temporal bones, as nearly as possible of the same size, and having perfect membranae tympani, were selected, the soft parts thoroughly cleared away and an opening made through the roof of the tympanic cavity. Through this opening a lance-needle was introduced, and the incudo-stapedal articulation and the tendon of the musculus tensor tympani divided. A hair-saw was then carried through the tympanic cavity from before backward, through the incudo-stapedal articulation, removing the petrous portion of the temporal bone and exposing the inner surface of the membrana tympani with the malleus and incus in position.

The preparations were then carefully washed, the membrana tympani and its attachments being afterward treated with a mixture of glycerine and water, one part to five, and the preparations mounted on wooden frames to which they were firmly attached by screws passing through the squamous portions of the bones.

The telephonic portions of the apparatus, for the construction of which I am indebted to Mr. Thomas A. Watson, were alike in each, and consisted of a disk of thin ferro-type plate, 7 mm. in diameter, a magnet 3.5 c.m. long and 4 mm. in diameter and a coil of fine copper wire having a resistance of 44 ohms. After thorough drying, the membranae tympani and the attachments of the ossicula were pencilled with a mixture of glycerine and water, one part to three, and the ferro-type disks were attached to the long processes of both malleus and incus by means of resin-wax, the centre of the disk coming against the tip of the manubrium mallei; the attachment was made to both malleus and incus, in order to insure the greater stability of the disk against the considerable attractive force of the magnet.

The magnets and coils were placed in position on cross-bars

fastened to the foot-plates of the frames supporting the preparations, and were carefully adjusted in equal relations to their respective armatures, the whole mounting of the apparatus, though of a very rough-and-ready character, sufficiently answering its purpose.

The telephones thus prepared were connected with an overhead wire something over 600 feet in length, passing from one house to another, and having proper grounding. With the same line were connected two hard rubber case hand telephones (Bell), the line being worked without a battery, and both sets of telephones being connected with the line through the medium of the large magneto-bell call-box, in use at that time.

From previous tests of the Bell hand telephone with König's rods, high musical tones, it was thought possible that, even allowing for the comparatively small size of the membrane, and the imperfections of the apparatus, high tones might be more readily transmitted by the ear telephone (the limit of transmission, using the Bell hand telephones with iron disks both as transmitter and receiver, having been found to be a tone of 10,240 v. s.), and in order to insure greater accuracy in so delicate a test, a rubber tube, having an ear-piece, was fastened into the meatus of the preparation used as a receiver, the listener placing the other end of the tube in one ear and effectually closing the other to the exclusion of disturbing sounds.

Under these circumstances, favorable to the test, the transmission of high musical tones not only did not exceed the limit of the hand telephones, but fell far below it, a tone of 8,192 v. s. being heard but very indistinctly.

A comparison between the ear and hand telephones was then made by listening for the sounds communicated by earth-currents and from neighboring wires.

The overhead line used in these experiments being an independent wire, grounded, has no connection with any other wire and is distant six feet from the nearest wire, which is a Western Union line in more or less constant use. Through the hand telephone there is usually heard, especially in damp weather, in addition to the sounds produced by earth currents, the click of Morse instru-

ments, the whirr of a "fast speed transmitter" (on the Western Union main line), and the tick of a clock, distant a quarter of a mile and connected with the observatory clock in Cambridge; all of these sounds occurring on lines more or less directly connected with the wire nearest to the telephone line used. None of these sounds, with the exception of a faint snapping, otherwise explainable, were heard through the ear telephone.

The next tests made were with low musical tones—reed pipes—and the voice.

The tones of the pipes, from 640 to 800 v. s., were plainly but faintly heard, the voice in conversation, speaking directly into the ear passage, was audible as a confused murmur, but not articulately distinguishable. Single tones and single vowel and consonant sounds were distinguishable, with this exception, that the consonant sounds accompanied by the greatest pneumatic pressure in their production were all heard merely as dull thuds, and could not be distinguished one from the other, this experience corresponding exactly with that in the membrane telephones, and in a lesser degree in the large iron disk box telephones first constructed by Mr. Bell, the explanation of which was given by the writer in a paper in a former number of this Journal. Having tested the ear telephones together as transmitting and receiving instruments, one was removed and a Bell hand telephone substituted as a transmitter; under these circumstances not only were the musical tones much more distinctly and loudly heard, but it was also possible to carry on conversation in one direction, using the ear telephone as a receiver.

These experiments, therefore, although working with the supposed advantage of a curved membrane, are fully confirmatory of the very thorough experiments of Mr. Bell on the use of plane membranes with attached armatures, the question here being not merely that of the readiest susceptibility to sonorous vibrations of the receptive disk or membrane, but also that of the relations of the armature to the magnetic field.

THE DRY TREATMENT IN SUPPURATION OF THE MIDDLE EAR.

By H. N. SPENCER, A.M., M.D.,
ST. LOUIS, MO.

A change of views from those I formerly entertained, and which seem to be at variance, judging from recent literature, with views held by aural surgeons generally, leads me to offer this contribution to the subject of the treatment of suppurative inflammation of the middle ear.

The common practice in acute troubles of this character, after an opening has been established in the drum-membrane (whether it has occurred spontaneously or has been effected by the needle), has been, in epitome, the warm-water douche and the air-bag operation. The bath is designed to keep the parts free from the constantly-renewed secretions, and in its temperature to afford a grateful application to the inflamed surfaces. It is also supposed that the heat influences favorably the course of the disease.

The air-bag acts by re-establishing communication between the naso-pharynx and the middle-ear, and tends to free the cavity of the tympanum; and probably the mechanical effect of the air-bath may have some tendency toward renewing a healthy action in the tissues involved. This is considered sufficient, in the majority of cases which have been seen early, to effect relief. If the suppuration continues, other means are resorted to—usually the instillation of one of the many astringent solutions. In chronic suppuration the repeated use of the bath is directed, and in the hands of the surgeon, after drying, the parts are medicated as they seem to him to require.

The treatment which I am about to describe, and which I have practised for two years or more, is radically different from this: and while it may have been followed by others besides myself, I am not

aware if this be true, and the note has not been made of it which I am persuaded it deserves. Becker has written an article (*Monatschrift für Ohrenheilkunde*, Vol. XIII., No. V.) on dry cleansing in otorrhœa, in which he claims an advantage for cleansing by means of cotton over the use of water by the syringe or douche. I think that he takes radical ground, but it is the opposite swing of the pendulum, and points to a recognition of the dangers which lie in the old method.

Prefatory to the consideration of a different mode of treatment I desire to point out what may be regarded as objections in the treatment by the bath. The middle ear, it must be borne in mind, is not reached by a stream of water which is directed against a drum-head that has not yet, or has but recently ruptured, and only infrequently and imperfectly in the case of older openings, unless there has occurred destruction of tissue in this outer wall of the tympanum. This at once limits usefulness of the syringe as a means of cleanliness to the effect it has upon the meatus.

In acute inflammation of the middle ear, again, if pain continues after rupture of the drum-head, the warm water, which affords relief during the moment of its contact, causes the pain to recur with increased energy on its suspension. This leads to a prolongation of the bath—in which procedure there is danger of involving other structures in the inflammatory process and of the further softening and consequent breaking down of the tissues of the membrana tympani.

Allowing these premises at all, the unavoidable conclusion is that there are cases of acute otitis media, where the bath had better be dispensed with; and in these cases to use the bath is not only to incur danger, but, from the treatment being ineffectual, there is to be taken into account the loss of valuable time which has been sustained.

I know the high esteem in which warm water is held, and confess that I have experienced misgivings in the past where I have omitted its use, and I now question, in some cases, the clearness of my judgment; but I submit if the following cases do not make it worth while to institute the question at least in our minds

as to whether or not water is *always* a valuable adjuvant to those other means—of leeching, tympanal inflation, dry heat, and the internal exhibition of opium—which we practise.

CASE I.—Daisy H., æt. 10 years, had an attack of scarlet fever five weeks previous to her call at my office, May 18, 1880. There arose, as a complication of her sickness, a double suppurative inflammation of the middle ear. The middle ear troubles on the right side led to the involvement of the external ear and to subperiosteal post-auricular abscess. Her father, who is a prominent physician, incised the tissues over the mastoid to the bone, and was under the impression that there was communication with the mastoid cells. This afterward was excluded. The discharge, at the time of her first visit to me, was quite profuse and very offensive. The ears had been treated by the syringe and with various astringent solutions—apparently to no purpose whatever so far as controlling the discharge went. I found that the inflammation of the right external ear had subsided, except some slight redness and swelling in the meatus—which was not more, however, than might be caused by the discharge which constantly bathed its walls. There was a circular opening in the right drum-head, about two millimetres in diameter, nearly central of the membrane, just below and in front of the manubrium mallei. The lining membrane of the tympanum showing through the opening appeared very red and swollen. The left side presented very nearly the same peculiarities in appearance, except the position of the opening which was higher up, still anterior to the manubrium. Rejecting the bath I cleansed the ears with very great care—using absorbent cotton on the cotton-holder both before and after Politzerization. I then applied powdered iodoform through the openings and closed the meatus with a loosely-fitting plug of absorbent cotton, which was inserted to the *bottom of the canal to rest upon the drum-head.* The wounds were dressed twice daily without any change from this treatment until the fourth day when the iodoform was omitted. On the fifth day the discharge had entirely ceased, and on the 1st of June the openings in the drum-heads had closed. I should not omit to state that a catarrhal condition of the naso-pharyngeal mucous membrane was treated by the insufflation of powders, and the pharynx, from time to time, received applications of liq. ferri subsulph. (1–4 parts of glycerin).

CASE II.—A. B. H., æt. 19 months, was brought to me May 18, 1880, with a discharge from the right ear, which had been first observed six days before. No treatment had been employed, except the internal exhibition of anodynes, to quiet the earache, which the sharp cries of the child and its peculiar behaviour even made evident to the mother. Its suffering ceased with the appearance of the discharge. Upon inspection, after cleansing the meatus by means of cotton, the opening was found on the anterior lower quadrant of the mem-

brane. The discharge was mucopurulent in character. Through the instrumentality of the air-bath and the dry dressing, as before described, the case was discharged, well, May 26th, no medication having been used.

Case III.—D. H., æt. 3 years. April 14, 1880. Has been suffering from inflammation of the right ear for two weeks following a mild attack of measles. The physician in attendance directed a medicated wash of some kind, with which the ear was to be syringed three or four times a day. These instructions had been followed up to the time of my visit. With the exception of a single application of argent. nitrat. (gr. xl.—℥ i.) to the wound in the membrane, which was made on the fourth day of my attendance, the treatment was the same as in Case II. The entire trouble had healed on April 23d.

Case IV.—I was called to see Miss A. C., æt. 28 years, February 19, 1880. I found her suffering intensely from pain in the right ear, on account of which she had been unable to sleep the night previous. Examination disclosed the drum-head very red and bulging. I made a paracentesis of the membrane at the point of greatest prominence on the lower posterior quadrant. There followed a slight sanguino-purulent discharge. After using the air-bag, the wound made in the membrane by the needle was dried by means of absorbent cotton, and the cotton plug introduced. Ordered morph. sulph., gr. ¼.

February 20th. Patient slept during the night, comparatively free from pain. Complains of "thumping" in the ear, and there is some acceleration of pulse. The discharge slight, and the membrane still considerably injected. Renewed dressing. Ordered two leeches to be applied to the tragus. The following day the discharge became quite profuse. There were no incidents presented in the case after this worthy of note.

Discharge had ceased on the 28th, and on the 4th of March my visits were discontinued.

Case V.—C. H., æt. 2 years and 6 months; was first seen February 26, 1880. For a discharge from the left ear no other treatment was used besides the Politzer bag, cleansing with absorbent cotton and the absorbent cotton dressing applied to the ruptured drum-head. Was discharged March 7th.

I might multiply the number of cases very many times from my records. Those presented serve to illustrate the point which I desire to make. The dry cleansing which Becker recommends has been followed—but it is the dry dressing to which I am inclined to attach more importance. It protects the wound from the air at the same time that it attracts the discharge from the middle ear, and causes a gentle stimulation, entirely unirritating, which conduces to healing. I have made it a practice, after placing the dressing, to use the air-bag, with the view of attaching the mem-

brane to the cotton by the moisture which would be forced through the opening.

I have designed in this way to exercise through the cotton a gentle traction on the membrane which would overcome the tendency to falling in, that obtains to a greater or lesser extent whenever its continuity is broken. If this can be obtained, the favorable influence which it would exert is obvious.

I do not claim for this method of treatment that it is applicable in every case, but it is largely appropriate and where it can be used, according to my experience, it insures a speedier good result, and does away with the injurious effects which in these cases would be occasioned by water applications.

I am disposed to lay down a law that the condition of complicity or not of the external auditory canal in the middle ear inflammation should decide the indication for the use of the bath in acute processes—and in chronic suppuration of the middle ear, I would restrict its use to cases of very profuse discharge, and to those cases presenting peculiarities in location of the ulcerative process, where to effect cleanliness by the cotton is either impossible or would be attended with a likelihood of injury from the irritation induced by prolonged manipulation. Or to express it in other words, water has no remedial virtue so far as the mucous membrane of the middle ear is concerned.

That it has been assigned this place relative to other mucous tracts, I think there is no doubt. And my position in regard to its value in aural practice can be readily appreciated by those of large experience in naso-pharyngeal and in gynæcological practices.

A negative argument in favor of a nicer discrimination in the use of the syringe in aural practice is found in the indiscriminate use which is made of it by the laity, and, I am sorry to add, by many general practitioners. Every one affected with deafness, it is considered, should have the benefit of the doubt, and inspissated cerumen is syringed for with a zeal which would be highly commendable if better directed.

A CASE OF PROBABLE ABSCESS OF THE BRAIN, FOLLOWING AFTER, AND PERHAPS DEPENDENT UPON, AN ACUTE INFLAMMATION OF THE MIDDLE EAR.

By FRANK ALLPORT, M.D.,

SYCAMORE, ILLINOIS.

The case here reported is one, I regret to say, of which no notes were made. My intimate relations with the deceased and the consequent occupation of my mind by thoughts of the greatest anxiety during his illness must be my excuse for not having made more accurate record of symptoms and indications serving to render a report interesting and instructive, and in default of which I am obliged to be content with a general description of the case.

The patient, F. E., a large and exceptionally hardy man, twenty-four years of age, started with a party of friends on a hunting expedition April 3, 1879. That evening they pitched their tents and went to sleep. During the night the weather changed, becoming exceedingly cold, and the heaviest snow-storm of the season set in. The patient generously divided his bedclothing among his companions, and, in consequence of the exposure, he had before morning a chill accompanied by slight fever.

The party was fourteen miles from home, for which destination it started at dawn in a heavy wind and snow storm, arriving before evening. On arrival, I was called in attendance, and found the patient in a high fever and complaining of severe pain in the left ear. There was no tenderness over the mastoid region, but examination of the membrana tympani showed it to be considerably congested.

The patient was put to bed and a brisk cathartic given. In addition about three ounces of blood were taken from the left temple, aconite and quinine were administered, and directions

given for the application of warm fomentations and the instillation of a warm solution of atropia (5 grains to the ounce) as often as seemed necessary for the relief of the pain.

On the following morning (April 5th), after a restless night. the congestion of the membrana tympani was found to have increased, and on the evening of the same day a free incision was made in the posterior inferior quadrant of the membrana tympani, from which pus began to flow freely by noon of the following day.

April 7th.—Inflation of the middle ear by means of the Eustachian catheter and air-bag was begun with, and in addition the ear was syringed with an astringent solution. From this time the patient rapidly recovered, and by April 11th the perforation had closed and the inflammation had nearly subsided. April 18th.—All congestion had disappeared, the membrana tympani was rapidly regaining its normal color and appearance, and the hearing, which had, of course, been seriously impaired, was nearly normal.

April 19th.—Contrary to advice, he went in the evening, in an open buggy, to a neighboring town on business, and on his return was overtaken by a heavy rain-storm, thoroughly wetting his clothing. He complained of neuralgic pain in the left side of the head and upper and lower maxillæ, but of no pain in the ear, although examination revealed a slight congestion of the membrana tympani. A brisk purgative, followed by aconite and quinine, was administered. Passed a restless night, but on the following morning the congestion of the membrana tympani had disappeared, the fever had subsided, and the only symptoms of which complaint was made was the neuralgic pain in the upper and lower maxillæ. From this date there were no further aural symptoms; the membrana tympani was found upon occasional examination to steadily improve in appearance, regaining its normal lustre and reflex until the whole hearing apparatus seemed at least normal, both in appearance and in function.

During the three weeks following, Mr. E. suffered more or less from neuralgic pain, confined principally to the upper and lower maxillæ, but sometimes affecting the eyes and occipital region. During each week the pain came under control, and on each Saturday all was undone by his own indiscretion. He was very fond of

hunting and fishing, and every Saturday repaired with his companions, contrary to advice, to the low river bottom in the vicinity. On one Saturday, after fishing, he laid down upon the river bank and slept for two hours. On another occasion he wet his feet and legs standing in the water while fishing, and finally, on a later occasion, he fell into the water, and came home thoroughly drenched. It will be evident, therefore, that there were considerable difficulties in the way of the successful treatment of the case.

Without particularizing in regard to the treatment pursued, I may simply say that the remedies applicable to such cases were administered, and that one or the other of these controlled the neuralgic symptoms until each Saturday, when everything was negatived as the result of one of these unfortunate excursions.

The last experience was, however, too much even for his robust constitution, and on Saturday night, May 10th, after his fall into the water, he complained of severe pain in the left side of the head extending into the frontal region.

Aconite and croton-chloral were administered, but he passed a restless night with considerable fever.

During the following day the pain and concomitant symptoms increased in severity. A cathartic was given, followed by large doses of aconite, bromide of potassium, and sweet spirits of nitre, and finally, the pain continuing unabated, morphia was administered. During the night he suffered excruciatingly, his speech was inarticulate, and he became wildly delirious. Medication was continued, and ice was applied continuously to the head. This condition alternated with periods of comparative quiet, during which articulation became perfect. The diagnosis of acute meningitis was made, and on May 12th Prof. J. L. Jewell, of Chicago, saw the patient in consultation, confirming the diagnosis and advising the exhibition of large doses of aconite, jaborandi, and veratrum-viridi. A dose of calomel was administered and morphia ordered as required. Ice-bags were also applied to the head and back. This treatment was continued, with the exception that on May 14th bromide of potassium was given and he was freely bled. From this time until his death he was very deaf, and a partial paralysis of the left side of the face was observable.

May 15th.—For the first time since May 10th he slept for a short time. May 16th.—At about one o'clock there was a copious discharge of yellowish pus from the nose, and at five o'clock of the same afternoon he died comatose. Unfortunately, no autopsy could be obtained, but the symptoms in detail and the copious purulent discharge from the nose left little doubt but that we had to deal with a frontal cerebral abscess which had made its exit into the nasal cavity.

The question which suggests itself in this case—in default of the post-mortem examination, which should have completed it—is the possible relation between the inflammation of the middle ear and the meningeal inflammation, in view of the fact of the restoration of hearing and of the normal color and appearance of the membrana tympani.

TINNITUS AURIUM.*

By SAMUEL SEXTON, M.D.,

NEW YORK.

The noises heard by persons when the transmitting mechanism of the middle ear admits of tissue conduction,† are often the only symptom of aural disease of which the patient is cognizant. The sounds heard are usually described as buzzing or ringing sounds, although, this depends much on the descriptive power of the patient, some not even alluding to this symptom when it manifestly exists.

Tinnitus aurium, it is believed, arises from the vibrations occasioned by the movement of the blood in the arterioles and capillaries in the immediate neighborhood of the auditory conductive mechanism; but other and louder sounds are also heard, perhaps less frequently, consisting of the cardiac and respiratory movements, of the utterances of the vocal apparatus, and the movement of the column of blood through the carotid canals—sometimes heard as rushing or gently flowing fluid, sometimes as pulsating or throbbing. Another group of sounds proceed from the friction of the articular surfaces of the ossicles themselves, either during excursions of the membrana tympani, or when the patient moves his head rather suddenly, or stoops. These sounds often seem to depend on the position of the patient's head, and are not, therefore, continuous. The concussions of the carotid artery in its bony canal, especially when fluid is present in the tympanum, will cause these friction sounds, their frequency being synchronous with the pulsations of

* An abstract of a paper read by title at the annual meeting of the British Medical Association, August 5, 1879.

† Vide "Hearing by the Aid of Tissue Conduction." "The Mouth Trumpet and the Audiphone." Samuel Sexton: AMERICAN JOURNAL OF OTOLOGY, April, 1880.

the artery. These sounds are described by patients as, "ticking," "rubbing," etc., or as "something loose in the ear." The pitch of these noises, which varies in almost every case and also at different stages of the affection, is likened by some to the jingling of delicate pieces of metal, and by others to the tapping together of wooden substances. The tympanic membrane also contributes its own peculiar noises, when its tension is lost, if agitated by sonorous vibrations, acts of respiration, and swallowing, or by eructations. In some conditions a rattling, like the crumpling of paper, occurs. Tinnitus aurium, moreover, is increased temporarily by aural hyperæmia or inflammation, flushing that affects the head; the excitement due to the use of stimulants, quinine, anæsthetics, mental emotion, and the straining at stool and labor. To the above incomplete list should be added the supposed contractions of the tensor tympani muscles, and the impaction of foreign bodies against the drum-head.

Tinnitus aurium can have no existence unless sound, capable of exciting the auditory nerve, has been produced, and, inasmuch as the physiological function of the nerve, is perceptive only, we are led to seek, in the operations of the transmitting mechanism, an explanation of the fact that noises of an intercranial origin—subjective—normally inaudible, become in certain cases audible to the patient himself. The writer has heretofore described his first observations on this subject; * from them the inference is made that tinnitus aurium cannot exist as a permanent symptom while aërial—normal—transmission of sound obtains. The causes of defects of transmission may be of temporary duration only, such as the hyperæmia of the parts from stimulants, the effects of a cold in the head, acute otitis media, and the like; from these the patient may speedily recover without serious defects remaining. When, however, a change in structure takes place in the mechanism, from trophic or other pathological causes resulting in the loss of tension of the membrana tympani, or in anchylosis or partial dislocation of

* "The Relations of the Conducting Mechanism of the Ear to Abnormal Hearing." Samuel Sexton: The Transactions of the American Otological Society, July, 1878.

the joints of the ossicula, the tinnitus is more or less permanent. In both the temporary and permanent conditions mentioned above, there frequently are found to exist collections of fluids or other products of inflammation in the tympanum from which serious interference to the movements of the transmitting apparatus may arise.

Whatever the character of the anomaly may be that constitutes the defect in the transmitting mechanism, the moment aërial transmission thus suffers impairment, the hitherto unheard undulations of sound arising from the circulation in the neighborhood of the ear are transmitted to the auditory nerve to a greater or less extent by tissue conduction, and in certain cases autophony and other phenomena are also present. The impracticability of tissue conduction in the normal state would seem to depend very much on the peculiar articulation of the malleo-incudal joint which permits of *outward* movements of the membrana tympani to a considerable extent, without any traction on the stapes being made; hence, the undulations of sound from the intercranial circulation, etc., are ineffectual unless the meatus externus be occluded, as by gentle pressure of the fingers, when, after passing *outwardly* they are reflected *back* again onto the membrana tympani inducing responsive excursions—the circulation (tinnitus aurium) remaining audible while the meatus is closed. Entire or partial absence of the transmitting structures of the middle ear, is frequently, in the writer's experience, attended with less tinnitus aurium than when the contrary condition obtains.

Tinnitus aurium is a symptom seldom absent in any of the chronic affections of the middle ear, and, when excessive, the conditions are unfavorable to hearing, and create more or less despondency or alarm to the patient. In acute aural affections it is scarcely ever absent, and not infrequently its manifestations are so marked that patients refer to it as pain; and when neuralgia coexists, as it often does, the presence of both conditions is to the patient indeed alarming. In some subjects of consumption and Bright's disease, where rapid and irreparable breaking down of tissue takes place, tinnitus aurium manifests itself quite suddenly, these patients being specially liable to experience the ticking noises to which

allusion has been made. In the sudden deafness from syphilis * the tinnitus aurium experienced is nearly always very great, and the symptom most persistent.

It is, perhaps, in advanced life that some of the most distressing instances of tinnitus aurium are found, the transmitting mechanism having become gradually defective from chronic inflammation or trophic changes. These patients should be speedily assured of the harmlessness of noises in the ears, and, in the writer's experience, the symptom under consideration cannot always be said to prognosticate either active or advancing aural disease. When the anomalies of transmission are associated with permanent defects, as is too often the case in chronic affections of the middle ear, tinnitus aurium seldom if ever disappears.

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* Vide "The Sudden Deafness of Syphilis." Samuel Sexton: American Journal of the Med. Sciences, July, 1879.

TWO CASES OF POISONING BY THE OIL OF CHENOPODIUM.

Reported by DR. ALFRED NORTH,

WATERBURY, CT.

The following cases are reported, as it is believed they will prove of some interest and value, both on account of the rarity of recorded instances of poisoning by chenopodium, notwithstanding its common use, and also because of the rather interesting nature of the symptoms developed:

Case I.—Five days previous to my being called, Jas. M., age twelve and a half years, was in fair general health, and complained only of that general lassitude and malaise common in the spring. The physician who was first summoned, however, diagnosed intestinal worms, and ordered the following mixture, of which a "large overflowing teaspoonful" was given to the patient at about 8 P.M. on May 21, 1880:

℞. Ol. chenopodii.............................. ℥ j.
Ol. terebinth.............................. ʒ j.
Extr. spigelii.............................. ʒ iij.
M. Sig. dose, ʒ j.

Three other children in the same family received smaller doses of this same mixture, with results to be mentioned below.

Saturday, May 22d.—Patient was found by the mother in the morning breathing heavily, and was with some difficulty aroused. His gait, when he tried to walk, was extremely unsteady, and without assistance he would have fallen to the ground. There seemed to be partial loss of co-ordination, as he was wholly unable to button his clothes or perform any ordinary complex movement. He complained of severe frontal headache and of loud ringing in the ears. Deafness was very marked, the patient distinguishing what was said to him only when it was spoken in a very loud voice and in close proximity to the ear. He appeared less intelligent than usual. Vision normal. During the day tinnitus aurium and deafness remained, but gait and general co-ordination improved.

Sunday, May 23d.—Slept soundly during the night. Headache and deafness with tinnitus remain the same. More drowsy than on previous day. Gait weak and shuffling, but patient sufficiently strong to walk half a mile and back to see physician, though much prostrated by the exertion.

Monday, 24th.—Slept heavily last night without waking until about 6

A.M. to-day, when he was found wandering aimlessly about the house in his night clothes. Mind now evidently affected. Weak, feverish, and very drowsy during the day. He has retained scarcely any food on the stomach since Saturday (22d).

Tuesday, May 25th.—All previous symptoms aggravated. Remained *in bed for the first time to-day.* The account so far has been obtained from the mother's recital.

Wednesday, May 26th, 7 P.M.—This evening I saw the case for the first time. I found the patient entirely unconscious, and learned from the mother that he had slept heavily all day. Temperature, 100° F., pulse, 58, weak and compressible. Respirations normal, breathing not stertorous. Pupils widely dilated, sluggish, responding only faintly to light. Had vomited on taking food during the day.

I ordered: bromide of potassium in fifteen-grain doses every three hours; wet cups to be applied to the temples; hot water and mustard to the feet, which were cold and clammy.

Friday, May 28th.—Patient remained much the same until yesterday, P.M., when, instead of lying as before, in a state of stupor, he began to be very restless. During the night and all to-day he has required persistent watching to keep him in bed. He is now the victim of constant hallucinations, starting up suddenly and calling out to look at imaginary objects; shouting to and pointing at fancied persons passing through the room; answering supposed questions, and carrying on considerable but very incoherent conversations with absent acquaintances. Temperature, 100.5° F., pulse 60. He seems partially to understand questions, and protrudes the tongue slightly after much urging. He is now sufficiently sensible not to void urine in bed. Enema given to move bowels, which have not acted since Monday, in spite of an eight-grain dose of calomel, and small doses of croton oil, given at different times.

Sunday, May 30th.—He has shown slow but steady improvement since the 28th, all symptoms abating somewhat in severity. During this time, however, he has slept only after considerable doses of morphia, hypodermically administered; on the 28th and 29th, Magendie's sol. ♏. v. being given at about 4 P.M., and ♏. x. at 8 P.M. No considerable abatement of the deafness. Noises in the ear continue.

June 1st.—Patient much better. Mind clear; appetite fair; no vomiting, for three days. Headache has diminished decidedly. Patient sits up in bed, and can walk a little without more difficulty than might be accounted for by the mere weakness. Hearing very little better, and complains as much as at any time of the ringing in the ears. Slept well last night without morphine.

June 4th.—Patient rapidly growing stronger; deafness slightly less; tinnitus a little diminished. No pain at any time in the ears, nor any change visible on examination.

June 5th.—Patient can just hear the ticking of a rather loud watch when pressed closely against the left ear, and not more than one-quarter of an inch from the right. Has a good deal of frontal headache, but no other symptoms save weakness.

Case II.—On the same evening, viz., May 21st, the sister of the previous patient, aged ten years, received a "good teaspoonful" of the mixture. She had been entirely well up to this time; the mother giving the medicine with no particular reason, apparently, except that she considered that children generally were better for taking something of the sort in the spring. The child was awakened toward morning by extreme nausea, followed by profuse vomiting. She fell asleep again in about an hour, and on wakening again at 7 A. M. was still much nauseated. She also suffered from inability to walk and adjust her clothing. Marked deafness. Distressing tinnitus aurium and severe frontal headache. In short, she was afflicted with all the symptoms which characterized Case I. up to the stage of stupor, only in a less degree. She was never compelled to take to her bed, but improved steadily though slowly, the deafness and headache being very persistent. On the fifth of June she was still very deaf, and could distinguish the ticking of the watch only half an inch from the left, and three-quarters of an inch from the right ear.

Two more children in the same family, viz., a girl of seven years and a boy of four, also each received a dose. The former took a teasponful; vomiting ensued shortly afterward, and on the following morning no symptoms presented themselves, with the exception of a slight nausea, which lasted but a short time. The latter child received half a teaspoonful. No nausea or any other apparent effect ensued.

It will be noticed that the symptoms presented by the cases described resemble somewhat closely those produced by santonin, its therapeutic ally. They differ, however, in the important particular that the eyes were wholly unaffected by the discolored vision uniformly produced by the latter drug, while the hearing, which so far as I can learn, is unaffected by santonin, was the only sense perceptibly affected by chenopodium. The only regularly reported case of chenopodium-poisoning which has come to the writer's notice is an instance found in the *Boston Medical and Surgical Journal* (Vol. xlv., p. 373). It occurred in the person of a slave child, six years old. In this case a bottle of the oil was given to the mother by a quack, with directions to administer to the child gtt. xv. doses (how often not stated), until worms were expelled. The patient died in thirty-six hours from the onset of the attack, which was marked by profound coma, stertorous breathing, small, weak, pulse,

convulsive movements, limited to the right side. The quantity taken in this instance cannot be ascertained even approximately, and the value of the case is therefore largely diminished. Also, owing to the extreme violence of the attack and the speedy death, the most interesting effect of the drug in the cases here reported—viz., the disturbed function of the auditory nerve—could not be observed if it existed. In the *New York Tribune*, of June 15, 1880, a fatal case is reported, where two doses, each of thirty "grains" of the oil were taken, three hours apart. No note of symptoms given, except that shortly after the second dose the patient, an adult, became insensible, and died soon after, despite the efforts of the physicians at Roosevelt Hospital, to which institution he was removed after the poisoning.

As to the amounts taken in my cases there is also an element of uncertainty. Had the drachm dose been given as ordered, the patient would have received forty minims of the oil, provided the *medicine had been well shaken*; but on standing the spigelia is almost immediately separated from the mixture, and settles to the bottom. In this condition a drachm of the supernatant fluid would give fifty-three minims of chenopodium. Moreover, on measuring the amount left in the bottle, it is found that ʒ vi. have disappeared from the original ℥ xii. mixture. The mother asserts that none was thrown away, and none given to any one else. Therefore ℥ vi. were distributed among the four children. The youngest is said to have received no more than ℥ ss. As no poisoning ensued, this is probably true. This would leave ʒ vss. to be divided among the three remaining children. Of this, to judge from the effect, the eldest must have received the lion's share, probably getting fully a drachm of the pure oil.

In conclusion, my reasons for reporting these cases at such length are, first, their rarity, to judge from the few published accounts; second, the peculiar interest which attaches to the symptoms referable to the auditory apparatus, in particular their singular persistence, the deafness now (June 24th) being very little diminished; and third, the valuable lesson of caution taught by these cases with regard to the use of this familiar drug, which seems to possess toxic properties with which it is not commonly credited.

CLINICAL OBSERVATIONS.

I. *Manometric Cicatrix of the Membrana Tympani.* CLARENCE J. BLAKE, M.D., Boston.—The following case, the third of its kind which has come under the observation of the writer, is reported on the supposition that those manometric cicatrices which indicate, with unmistakable clearness, and in a degree which is not easily overlooked, the variations in pneumatic pressure in the tympanic cavity, are comparatively rare.

The two previous cases were reported, one in the "Transactions of the American Otological Society for 1875," and the other in the first number of the *Archives of Ophthalmology and Otology*, 1876. The study of these, and their suggestion of the possible utilization of similar cases for further experiment, induced a close watch for similar appearances, and although cicatrices of the membrana tympani were observed in which there was a slight and almost imperceptible movement in response to the lesser changes in intra-tympanic air pressure, no case has been observed, until the present, in which the cicatrix was so delicately balanced as to respond, in a sufficient degree for accurate observation, to the changes in pressure in the middle ear accompanying natural respiration and phonation.

The patient, a woman, 40 years of age, had suffered when a child from an acute inflammation of the right middle ear, followed by a long-continued purulent discharge which finally ceased, leaving the hearing considerably diminished. The hearing in the left ear remaining good, but little attention was paid to the condition of the right ear until a further diminution of hearing in the latter induced her to seek advice.

Examination of the right ear showed the whole of the posterior and inferior segments of the membrana tympani to be much thickened and studded with small calcareous deposits, not distinctly

marked and individualized, as is more frequently the case, but closely set together. The anterior segment of the membrane was represented by a transparent cicatrix closing an oval perforation, the longest diameter, from the anterior superior to the posterior inferior border of the cicatrix, being about four millimetres; the long process of the malleus appeared considerably foreshortened. Tests of the hearing gave, with the Politzer acoumeter, a distance of 20 centimetres, with the voice in ordinary tone at a distance of 4 metres, a considerable difficulty in distinguishing the softer consonant sounds. The hearing for high musical tones was below the normal standard, and a tuning-fork held between the teeth was heard better in the right ear.

The left ear was found to be very nearly normal in its appearance and in response to hearing tests.

Valsalvian inflation slightly improved the hearing in the right ear, this improvement pertaining, however, only during maintenance of the pressure, and on examination during inflation the cicatrix was seen to move outward for a distance estimated as considerably less than one millimetre, immediately relaxing on the suspension of the inflation. Having been allowed to return to its former position the cicatrix was then seen, as indicated by the light reflex upon its surface, to move regularly with the natural respiration, with each inspiration making an excursion inward, and with each expiration a corresponding movement outward. Hurried and forced respiration increased both the rapidity and degree of the movement of the cicatrix. To test the influence of phonation, consonants, especially *m*, *n*, and the *ng* sound, were sounded by the patient with the lungs as fully inflated and as fully exhausted as possible, with no appreciable effect upon the cicatrix; when this membrane was apparently in the middle of an excursion, there appeared to be a slight and sudden movement outward in response to the sounding of *ng*, and of the final *n* in such words as *garçon*.

This case, therefore, did not so well illustrate the existence of intratympanic pressure during phonation as did the two previous cases, nor did this patient complain, as the others had done, of the disagreeable sensation of a to-and-fro movement in the ear during respiration.

In this, as in the previous cases, the manometric character of the cicatrix is explainable by the supposition of the gradual stretching of an originally tense cicatrix in consequence of repeated inflation during the persistence of head colds, and later for the purpose of temporarily improving the hearing, and also possibly in consequence of prolonged repeated preponderance of atmospheric pressure from without inward during closure of the Eustachian tube. The more recent diminution of hearing in this case is probably similarly explainable. The sound-waves, being less readily transmitted under the condition of a relaxed and moving cicatrix than when the cicatrix corresponded more readily in its tension to that of the membrana tympani, and the compound structure, if such a term may be used, responded more readily in vibration as a whole.

That similar cases should have escaped record is readily supposable, but it is hardly possible that very many should not have been seen by other observers, and had this patient, on the other hand, further delayed the opportunity afforded for examination, it is probable that the cicatrix would have become so much more stretched as to have lost its manometric distinction and have presented the appearance of the ordinary relaxed cicatrix; it should be noted, however, that in each of these cases the cicatrix was situated in the anterior portion of the membrana tympani with its plane across the opening of the Eustachian tube.

II. *Unnatural Patency of the Eustachian Tube.* ALBERT H. BUCK, M.D., New York.—On reading the preceding communication of Dr. Blake, in manuscript, I remembered having seen, some years since, two cases which are fairly comparable with that described above. I hunted up the notes of these cases, and give below the more important facts that I was able to gather from them. The diagnosis made at the time, in both cases, was that which I have placed at the head of this communication.

In both of the cases referred to the patient did not seem to be conscious that the ear was in any respect peculiar. Both patients consulted me for the relief of a slowly-increasing deafness, associated, in one case, with a distressing tinnitus. In the first instance I found a large, sharply-defined, oval cicatrix occupying the pos-

terior inferior quadrant, and encroaching a little upon the superior quadrant. As I watched the drum-membrane, through the speculum, and by means of reflected light, I noticed that this cicatricial portion performed well-marked to-and-fro movements, which corresponded accurately with the patient's expiration and inspiration. When she held her breath, the cicatricial membrane remained perfectly motionless. Inflation by means of Valsalva's method caused the cicatrix to protrude in the form of a well-defined hemispherical tumor; but as soon as the pressure was withdrawn, the cicatrix instantly returned to the plane of the surrounding membrane, and again performed its to-and-fro excursions, synchronously with the respiratory movements. In the second case, the entire membrana tympani presented a decidedly atrophied condition. The tip of the manubrium mallei was lacking. On questioning the patient I ascertained that in childhood she had been subject to a discharge from that ear. From these facts—viz., the absence of the end of the handle of the hammer, and the existence of otorrhœa during childhood—I drew the conclusion that the unusually thin membrane was not, as I first supposed, an atrophied membrana tympani; but represented a newly-formed drum-membrane. Whenever the patient performed the act of swallowing, this cicatricial or newly-formed membrane made a distinct to-and-fro excursion. The respiratory movements, however, caused no visible excursion of the membrane. It is quite possible that, notwithstanding this absence of a respiratory excursion, the Eustachian tube was just as patent in this as in the first case. The much greater area of the cicatricial portion in the latter case would necessitate a correspondingly smaller excursion of any one portion of the membrane to which I might direct my attention—an excursion probably too small for the naked eye to detect.

In seeking for a cause for the extraordinary patency of the Eustachian tubes in these two cases, we should bear in mind that both of them furnished unmistakable evidence of a pre-existing destructive inflammation of the middle ear. Instances are on record where such an inflammation caused the destruction of the lower wall of the osseous portion of the Eustachian tube, and

eventually led to a fatal issue through ulceration of the walls of the carotid artery. If, however, the progress of such a destructive inflammation should be arrested before the carotid artery became involved, and if reparative action should then set in, I can see no good reason why an unnaturally patent Eustachian tube should not be the ultimate condition left when the ulcerated parts had fully healed. Again, I am not at all certain that an unnatural patency of the Eustachian tube may not result from a change in the relations of the soft parts which immediately surround this canal. Some years ago, while gaping, I suddenly discovered that I had unconsciously rendered one Eustachian tube unnaturally patent. I succeeded in keeping my jaws in this peculiar position long enough to satisfy myself that it was a possible thing to maintain the Eustachian tube in a perfectly patent condition for a shorter or longer time, according to the will of the experimenter. The rushing sound caused by the air as it passed to and from the middle ear with each act of respiration, the easily felt to-and-fro movement of the drum-membrane, and the cool sensation caused by the moving current of air, all furnished unmistakable evidence of the existence of an open channel of some size between the naso-pharynx and the middle ear. I have often tried since to reproduce this condition, but have only succeeded partially. It is not an uncommon thing, however, for patients who suffer from chronic Eustachian catarrh, to learn the knack of twisting their jaws in such a way as to open, for an instant, the obstructed Eustachian tube, and in this manner to obtain relief from the sensation of pressure which many of them find so annoying.

BOOK NOTICE.

Die Gesetze der Physiologie und Psychologie über Entstehung der Bewegungen und der Articulations-Unterricht der Taubstummen. Von Dr. W. Gude. Director der provincialständischen Taubstummen-Anstalt in Stade. Pp. 80. Leipzig: W. Engelman, 1880.

This monograph on a very important subject, is divided into three parts, the first of which is devoted to a consideration of the ordinary laws of physiology and psychology governing muscular action, especially that form occurring in speech. In the second part the author, after having established a physiological basis, as set forth in the first part of his brochure, says that a twofold task is set before him, viz.:

1. To prove that the physiologico-psychological laws governing the calling forth and management of motion in the instruction of mutes in articulation, are, to a greater or less extent, unconsciously made use of by those employed in teaching, and that this fact, being confirmatory of the correctness of the experiments of physiology, is a reason for its currency.

2. To show that by a wider application, coupled with an accurate description of these forms of excitation, the theory and practice of instruction of mutes in articulation, may be placed on a natural foundation, and thereby advanced.

It is further asserted by the author, that the visible and sensible motions which occur not only in the organs of speech, but also in the adjacent parts of the body, during the act of speech, are scarcely noted by those in full possession of all their faculties. If, now, these movements are to form the means of instructing deaf-mutes in the power of speech, the first supposition is that they must enter into the province of perception as distinct manifestations of motion. In regard to the natural development of speech, by means of the reflex excitations of the auditory nerve through the movements in speech, it is evident, both from a physiological as well as a psychological point, that it occurs before the development of consciousness is completed; and further, it is evident that the mind thus for the first time finds itself in a position of ascertaining facts by these external excitants, and finally that these excitants, without any special intention on the part of the speaking surroundings of the child, impress

themselves on the ear of the latter. By analogy the conditions of the development of speech in a deaf-mute are altogether the opposite. Three questions are then proposed by the author:

1. How can speech-movements be called forth in the deaf and dumb?
2. How can these be separated from improper concomitant movements?
3. And what directions can be given for their combination.

The first question is considered the most important to the demonstration which follows. This treats not of the position and movement of the organs of speech, in the formation and utterance of each vocal sound, but rather of the means of inducing the deaf-mute to bring about the desired positions and movements of the vocal organs. Then follows a minute description of the method to be employed by teachers of articulation to deaf-mutes, by which they may arouse their attention and convey to them the physiological methods of speech.

The entire work is based on the laws of physiology and psychology as laid down by the best authorities in Germany. The author too, though not a physician, has devoted a long time to the study of the physiology of the vocal organs, and to that of the nervous system, before he proceeded to write his brochure, which is now written purely to guide his colleagues in the great work of instructing deaf-mutes in articulation.

This short notice does not profess to be a review of this book, but rather has for its object merely to call the attention of the instructors of mutes to the vast importance as well as the possibilities of this subject. An elaborate review of the book in this magazine would not be within our province, but the book deserves our attention if no more than to remember its existence and to urge its perusal on the leading instructors of the mute, in this country.

The Germans are doing more in instructing mutes in articulation than is generally supposed. And yet, even they are fully conscious of the deficiencies existing in their institutions where articulation is being taught. Too often a defect in the means of instruction is misconstrued into an inability on the part of mutes to learn to talk; but a glorious future must be before a method which, though comparatively yet in a state of crudity, can even now make the majority of mutes talk when brought under its influence. In all estimates of teaching articulation to mutes, by teachers of mutes, the method now in vogue by most teachers must be remembered. The subject of articulation is yet in its infancy, and of course has to enter into unfavorable comparison with an old-established method, and as it seems that the two cannot flourish together, the new method must necessarily struggle for its existence.

It is not likely that old teachers of the old method can or will learn the new method; the changes must be gradual, and come into use through young teachers. But if anything is attained in teaching articulation to mutes, even as an accomplishment, as at present in some institutions, this serves as a proof

that vastly much more can and will yet be done, when articulation becomes a means as well as an end of instruction.

The inability of some mutes to learn to talk is no reason why the majority of mutes should be deprived of a chance of learning it. For a mute who cannot learn articulation is probably unable to learn anything well. It has been urged that mutes have no idea of what articulation is, which is very true. The reason of this is that so many years, say six or seven, are allowed to pass by without conveying to the brain of the mute any idea of speech, an idea which the brain of the child who hears, gains by the end of its first year to such an extent as to have the incentive to try to speak.

With these facts in view, the author of the book in consideration has tried to indicate to his colleagues, ways of conveying to the brain of the mute an idea of the processes in the human body necessary to produce speech. When this idea is once gained and the movements started, and the reflex relation between brain and muscle fully established, a vast aid is granted to the mute to learn to talk.

REVIEWS.

Presentation of Sonorous Vibrations by Means of a Revolving Lantern. Henry Carmichael: *Amer. Jour. Science*, April, 1880, p. 312.—This paper describes an improvement upon the revolving lantern, devised by the writer, and presented at the meeting of the American Association for the Advancement of Science in 1874.

The original instrument consisted of a long arm of gas-pipe revolving in a horizontal plane and bearing at a right angle a burner shielded by a glass cylinder. The long arm of gas-piping was bent at a right angle at its distal end and made to form a gas-tight joint in slipping over a smaller gas-pipe fitted upright in the base-block of the machine. This latter pipe was connected with a König's manometric capsule.

When the arm of gas-piping was set in motion, forming the radius of a circle of which the gas-jet represented the periphery, a continuous line of light was presented, the line or band of light being broken up into corresponding serrations whenever a tone was sounded opposite the manometric capsule. This apparatus affording certain advantages for purposes of lecture demonstration and experiment over the usual method of exhibiting as serrations the movements of a sensitive flame by reflection in a revolving mirror.

In the improved instrument the revolution is effected in a vertical plane. The light is rendered more brilliant by the introduction of oxygen, and accidents from breakage are avoided by substituting mica for glass in the cylinder surrounding the flame. The central gas supply-tube, tipped with a steatite burner, is bent at a right angle, a short distance below the tip, into the axis of revolution. The oxygen supply-pipe, surrounding the gas-pipe nearly up to the tip or burner, is also bent at a right angle in the opposite direction to that of the bend in the gas-pipe, and the two just form the shaft or axis around which the revolution of the flame is effected. The manometric capsule is connected with the stationary gas-pipe into which the revolving gas-pipe sockets. The mica cylinder surrounding the flame is capped with a perforated disk like the top of a pepper-box, and the steatite tip or burner has an internal diameter which will send a flame, with the gas at full head, to the top of the cylinder. "The lantern is revolved by a multiplying wheel or by a powerful clock-work when a uniform motion is required. When the oxygen is diluted with two

measures of air it is more easily regulated as a supporter of combustion, and the brilliancy of the flame is considerably increased by passing the gas through a sponge saturated with 'gasoline.' By regulating the flow of gases and giving the flame a rapid rotation, a continuous brilliant ring is produced, which is broken up into saw-like teeth, characteristic of the pitch, intensity, and quality of the entering sounds.

"A shrill whistle produces teeth so fine that they are barely visible at a distance of thirty feet. A loud low sound affords teeth of the height of the mica cylinder. three or more inches long, with one or two harmonic teeth surmounting the fundamentals. A rough roar yields large jagged teeth, exceedingly complicated and curious.

"On turning down the flame the teeth are reduced to brilliant dots, with smaller dots between them if the harmonics be present. It is curious to observe that no trace of flame can be seen between these dots, which may be three inches or more apart."

For investigating the motions of sonorous bodies, the author has constructed a substitute for the manometric capsule, which he calls the manometric pad. This is simply a wooden funnel, the mouth of which is covered with thin rubber, and the neck connected with two flexible tubes, one of which brings the supply of coal-gas and the other conveys the sonorous vibrations to the revolving lantern. The manometric pad distended with gas is placed in direct contact with vibrating bodies, and as the flexible tubes permit of its being moved without interfering with its connection with the lantern, its position may be so altered in relation to the sounding body as to make its contact with segments or nodes, and their consequent location in the sounding body, readily demonstrable in the lantern.

STABILITÉ CHIMIQUE DE LA MATIÈRE EN VIBRATION SONORE. M. BERTHOLET: *Comptes Rendus de l'Acad. des Sciences*, Paris. May 8. 1880.—1. In this communication the author says: A multitude of chemical transformations are now attributed to the energy of ethereal matter transmitting vibratory movements and producing the phenomenon of light, heat, and electricity.

This energy, communicated to ponderable matter, results in decompositions and recombinations, and it is in this view that consideration is taken of the subject of sonorous vibrations in their effect upon chemical combinations, touching particularly upon the study of explosive substances with which the author has been especially occupied during the past ten years.

The ingenious experiments on this subject which have been published by Nobel, Abel, Champion, Pellet, and others go to show that explosive substances may be discharged under the influence of certain musical notes to which they vibrate in unison, but the results obtained do not settle the definiteness of the theory beyond contradiction. The explosions produced by dynamite and gun-cotton are explainable simply by the direct effect of the

shock propagated by the gas for short distances, and as concerns the iodide of nitrogen, the principal subject of these experiments relative to explosions by resonance, it is a substance so sensitive to disturbance that the question is at least permissible whether the discharge was not the result of the jar and friction of its supports in consequence of their own sympathetic vibration. With this view it seemed advisable to the author to repeat these experiments, employing gases and liquids in place of powders as forms of matter more suitable than a powder for the propagation of a vibratory movement, properly speaking.

For this purpose choice was made of substances decomposing with liberation of heat, reducing the rôle of the vibratory movement to the provocation of the reaction. In other words, the experiments were made with unstable substances, and these in a state of continuous decomposition to be merely accelerated by the influence of the sonorous vibrations. The apparatus employed in the experiments consisted of: 1, a large horizontal diapason in connection with an electric interrupter, one of the arms bearing a flask having a capacity of 250 c.c., containing the gas or liquid, the other arm carrying a mass of corresponding weight. The effective vibration of the flask, or of its contained liquid, was verified by the usual optical tests. The apparatus afforded a vibration at the rate of about 100 simple vibrations in the second.

2. A large horizontal glass tube, closed at both ends and having a capacity of about 400 c.c., was set in vibration by means of a horizontal wheel. This simple apparatus, tested by König, gave a very clear tone of 7,200 single vibrations in the second. The substances employed in the experiments were ozone, arseniuretted hydrogen, sulphuric acid in presence of ethylene, oxygenated water, and anhydrous sulphuric acid. In the experiment with ozone, vibration was maintained with the first apparatus one hour and a half, and with the second apparatus half an hour without appreciable effect. Ozone is a gas transformable into oxygen with liberation of heat, the change progressing slowly and spontaneously. By this experiment it appeared that this transformation was not accelerated by a movement in vibration of 7,200 in the second continued for half an hour. Its spontaneous transformation could therefore in no degree be attributable to the sonorous vibrations which are constantly traversing the air. Arseniuretted hydrogen, subjected to the same vibration for a space of half an hour, underwent no change; at the end of twenty-four hours there was a slight evidence of metallic arsenic, but no more than in a similar tube filled with the same gas which had been carefully protected from vibratory influence for the same period.

The experiments with sulphuric acid and ethylene gave similarly negative results, as did also the experiments with oxygenated water and anhydrous sulphuric acid; the conclusion to be drawn being, according to the author, that matter is stable under the influence of sonorous vibrations.

THE ACOUSTICAL SHADOW OF A CIRCULAR DISK. LORD RAYLEIGH: *Phil. Magazine*, April, 1880.—In this paper the author gives the recently successful results of his attempts to obtain the acoustical analogue of the experiment suggested by Poisson, in which a bright point is observed in the centre of the shadow of a circular disk on which waves of light are directly incident. The difficulties to be overcome are entirely different in optics and in acoustics, on account of the immense disproportion of wave-lengths. In the former case the disk must be small and accurately shaped, and the source of light must be of very small angular magnitude—in practice an image of the sun formed by a distant lens of short focus. In the latter case the difficulty is to arrange the experiment on a scale that shall be adequate in comparison with the wave-length of the sound. In order to do justice to this communication it is presented in full. The best way, says the author, of considering the subject theoretically, is with the use of Huyghens's zones. The plane of the disk is divided into zones by its intersection with spheres whose centres are at the point under consideration and whose radii form an arithmetical progression with common difference $\frac{1}{2}\lambda$. The vibrations due to these zones are at first nearly equal, but gradually diminish to nothing, unless the outer boundary of the aperture is circular; and thus the aggregate effect is represented by a series of which the terms are of opposite sign and of slowly diminishing magnitude.

Now the sum of such a series is equal approximately to half its first term; so that the whole effect of the aperture, outside the disk, is independent of the disk's diameter—that is to say, is the same as if no obstacle at all were present.

This way of regarding the matter shows at once what degree of accuracy is required in the figure of the circumference which must not sensibly encroach upon the first exterior zone.

If x be the radius of a circle in the plane of the disk, b the distance of the point under consideration, and $r^2=x^2+b^2$, $dx=rdr \mid x$; so that if $dr=\frac{1}{2}\lambda$, $dx=r\lambda \mid 2x$. If, therefore, x be the radius of the disk, the radial curve should be a small fraction of $r\lambda \mid 2x$. In like manner we may form an estimate of the size of the bright spot, a subject which has been treated analytically by Airy (*Phil. Mag.*, May, 1841).

If the disk be moved laterally through the width of our zone, it is clear that the effect at the old point will be materially changed. Hence the diameter of the bright spot is comparable with $r\lambda \mid x$, and its apparent magnitude as seen from the disk is comparable with $\lambda \mid x$. For the full success of the experiment, the apparent magnitude of the luminous source should be of the same order.

When we pass to the analogous experiment in acoustics it is of course impossible to retain any approximation to optical conditions. Instead of a ratio of $\lambda : x$, equal, to say, $\frac{1}{10000}$ we must be satisfied with some such value as $\frac{1}{20}$. In order to diminish λ as far as possible, it is advisable to use sounds of very

high pitch, which have the additional advantage of readily exciting sensitive flames. It was found best to work indoors, in which case a disk of 15 inches diameter is suitable; with a much larger disk, and in an ordinary room, there would hardly be sufficient free space on all sides. The sources of sound tried were of considerable variety, including electric sparks, a small electric bell, and a Galton's whistle; but the best results were obtained with a bird-call and with a squeaky toy-reed. On one occasion the source was a bird-call blown with a pressure of 4″ water, and was placed about 20″ from the 15″ disk. The observation was made at a distance of 24″ on the further side of the disk, and was successful both with the ear and with the sensitive flame. In the former case a plate of wood, bored with a hole about ¼″ in diameter, was used and held against the head in such a position that the hole was opposite the ear-passage. The head was moved about until the position of maximum sound was determined and was then withdrawn, leaving the plate *in situ*. In order to verify conveniently that the position of maximum sound was really at the centre of the shadow, a hole was bored through the centre of the disk, which could be closed with a cork during the adjustment of the ear-plate. When the adjustment was complete the cork was removed, and then the eye, placed behind the ear-plate, could see the source of sound through the two holes. With a little practice the central point could be picked out almost as well by ear as by eye. With a sensitive flame the observation was even easier. The most suitable flame is that from a pin-hole burner brought near the flaring point by a gas pressure of about 10″ of water. To get the best result the pressure must be carefully adjusted, and in order to avoid disturbance it is advisable to move the source rather than the flame. When the place of maximum effect has been determined, the cork is removed from the central hole in the disk and the gas is lowered. By looking just over the burner it is then easy to see whether or not the source of sound occupies the central position. On another occasion the toy-reed was substituted for the bird-call, the disk and distances being the same as before. In the case of this source the experiment succeeded better with the flame than with the ear. On a subsequent occasion a larger disk of 30″ diameter was tried, but the results were not so good, probably in consequence of the increased effect of reflection from the floor and walls of the room.

A New Form of Siren. Lord Rayleigh: *Phil. Magazine*, April, 1880.—Some years ago the author had observed that a light pivoted blade was set into rapid rotation when exposed to wind, the phenomenon being of the same character as the rotation of a slip of paper falling freely in the air which was discussed by Prof. Maxwell in 1854 in the *Cambridge and Dublin Mathematical Journal.*

In both cases the rotation may occur in either direction, proving that its course is not to be looked for in any want of symmetry. The present paper

concerns merely the practical application of the phenomenon. A blade or sheet is cut out of sheet brass, having at each end sharp projecting points which bear in hollows in the ends of two screws: these screws pass through the ends of a light wooden frame open at the sides and can be adjusted until the blade turns freely without perceptible shake.

The openings at the sides of the frame-work not being entirely filled by the blade when the plane of its surface is in a line with the plane of the side of the frame-work, pieces of cardboard are introduced above and below the blade, nearly touching its upper and lower edges, so that the frame is nearly closed. As the blade turns, it acts the part of a revolving stopcock. In the summer of 1878 several sirens were made upon this plan, which performed well. In the siren represented in this paper by illustration, full size, the frame-work is 5·3 centimetres long by 3 centimetres high, and the blade 2·8 centimetres long by 1·1 centimetre wide. If the wind from the bellows is admitted symmetrically, the blade will revolve in either direction and soon acquire sufficient speed to give a note of moderate pitch. The position of maximum obstruction is for small displacements a position of stable equilibrium. If a larger displacement is given, the vibration tends of itself to increase up to a certain point, or even to pass into continuous rotation; but the precise behaviour in this respect probably depends upon the details of construction.

A Contribution to the Normal and Pathological Anatomy of the Temporal Bone, with Especial Regard to the Temporal Bone of Children. Kiesselbach: *Archiv für Ohrenheilkunde*. Bd. 15, 1880.—The writer proposes to investigate the relation of the mastoid cavity to the external wall of the temporal bone at various ages; also to determine the frequency with which openings exist in this bone at various times of life. By collecting a number of cases where these openings occur he hopes to help the solution of the question whether they are congenital or not, and also do something towards explaining the existence of spontaneous supra-mastoid pneumatocele cranii.

Anatomy of the Squamo-tympanitic Portion.—The boundary between the squamous and mastoid portions of the temporal bone was formerly considered to be the temporal ridge, thus reckoning that posterior portion of the squamous bone which in the new-born forms part of the external wall of the mastoid cavity as belonging to the mastoid. In reality this boundary is indicated in adults by a line which extends from the parietal incisura down on the mastoid process to a level with the lower end of the external auditory meatus where it turns forward to end at the mastoid incisura, thus dividing the mastoid process into an anterior smooth portion belonging to the squamous bone, and a posterior rough portion belonging to the mastoid bone.

J. Gruber has pointed out the relation of the external portion of the petro-squamous suture to the mastoid cavity and process. This external portion of

the suture he calls the "mastoideo-squamous fissure" in distinction from the internal portion, the petro-squamous fissure. Kirchner has given a collection of many cases of the extension of an inflammatory or catarrhal process from the tympanic cavity to the external wall of the mastoid process. He ascribes the frequency and facility of this extension to the persistence of remains of the squamo-mastoid fissnre. Out of 300 skulls examined by him, one or both fissures were more or less open in 23 per cent.

In the new-born the mastoideo-squamous fissure extends from the parietal incisura to the posterior and upper part of the tympanic ring. It may be divided into three parts. of which the upper extends as far as a notch in the squamous bone about 2 mm. long, which is in rare cases the beginning of a canal leading to the squamous portion of the mastoid cavity. This upper portion may be wanting. The middle portion extends from the notch described to the point where the line which separates the vertical from the horizontal portion of the squamous bone reaches the posterior border of this bone. At this notch the two tables of the squamous bone separate, the internal forming with the tegmentnm tympani the petro-squamous fissure, while the external covers the mastoid antrum on the outside. The boundary between the upper and middle thirds of the mastoideo-squamous fissure marks the upper end of the mastoid antrum. The lower third of the mastoideo-squamous fissure is bounded behind and above by the future mastoid process; in front and below by the posterior border of the squamous process which carries the posterior end of the tympanic ring. This squamous process the author names "processus tympanicus squamæ," and it is here that the squamons and mastoid bones first unite, the union being almost invariably complete at birth. The author examined 174 skulls from subjects under 20 years of age, and found that in 70 per cent. of those more than one year old both sutures were closed completely, while in only 4 per cent. of those under one year were both sutures closed. In six cases both sutures were open, and of these six cases five were under ten years of age. When the suture does not close completely, the foramina left are usnally too small to admit a bristle.

There are a nnmber of cases quoted of openings from the outside into the mastoid cavity, and less frequently into the tympanum. In these cases the site of the opening was in the small depression just above the spina supra meatum, the latter being wanting or stunted. Zuckerkandl claims that an examination of the temporal bone of an embryo before the second month showed that the formation of these openings is due to an arrest of development, the site of the future processus tympanicus squamæ being at that time an independent process of bone which unites with the squamous portion at the point where the openings mentioned occur. The author was not able to verify this owing to the absence of an embryo of the proper age, but found in one a little older that the process and the squamous portion were united. In the author's experience openings in the wall of the temporal bone have been for the

most part in the external table of the squamous bone and in that portion which enters into the formation of the external wall of the mastoid cavity. Before discussing these foramina farther, he makes some observations upon the anatomy of this region.

The spina supra meatum is at the beginning of a line branching downwards from the beginning of the temporal ridge and separating the vertical from the horizontal portion of the squamous bone. This spine was found in 80 per cent of the skulls examined. The portion of the squamous bone which in the new-born forms the external covering of the mastoid cavity, is bounded above by a line extending from the apex of the angle formed between the temporal ridge and its descending branch to the point of division between the first and second portions of the mastoideo-squamous fissure, the angle described being directly over the anterior end of the mastoid antrum; the lower boundary of this portion of the squamous bone is formed by the descending branch of the temporal ridge; the posterior by the middle third of the mastoideo-squamous fissure. This portion of the squamous bone in adults covers that portion of the antrum which is occupied by the squamous cells. In children it is often very thin and transparent, and sometimes pierced by numerous foramina. The author describes several such cases, the foramina being for the most part in a group closely in front of the mastoideo-squamous fissure. He also describes the rare case of an opening into the mastoid cells proper, the external opening being in the horizontal portion of the squamous bone, half-way between the margo tympanicus squamæ and the spina supra meatum. Such openings are rarely found in adults. Out of two hundred skulls examined, only one case was found, the position of the foramina agreeing with the cases in children just described and leading to the conclusion that they were due to the same cause—that is, were congenital. Another opening which sometimes exists and is found behind the posterior articular process is called the false jugular foramen. It is due to the persistence of the foramen by which the primitive jugular vein left the skull.

These openings in the external wall of the temporal bone are of the most importance practically, which lead into the air-spaces of the middle ear. These may be either the mastoideo-squamous fissure, or in adults gaps left by its incomplete closure, or foramina such as have just been described. Schwartze thinks these last due to congenital defects of ossification, and with this view Kiesselbach agrees. Both forms of openings explain the sometimes surprising extension of inflammation of the middle ear to the external wall of the mastoid process, as well as the existence of the so-called pneumatocele cranii. Bezold says of this, that the posterior boundary line of the pinna corresponds nearly in position with the mastoideo-squamous fissure. The purulent matter escaping through the fissure acts like a wedge between the bone and the pinna, and the latter being securely fastened in front is forced into a characteristic position perpendicular to the side of the head. This is much less common in

adults than in children, because of the greater distance of the external wall from the original seat of the disease.

The explanation of emphysema in the neighborhood of the mastoid process and pneumatocele cranii supra-mastoidea was a matter of great difficulty before the discovery of defects of ossification in this neighborhood. Senile atrophy did not explain it, because it occurred in middle life and sometimes in skulls where the bone was very thick. Hyrtl suggested that it might be due to repeated strong pressure in the air-chambers of the middle ear, occasioned by such acts as sneezing and blowing the nose, making a comparison between pressure from this source and that exerted by a dilated blood-vessel upon the neighboring bone. The author thinks that such increases of air-pressure are probably the immediate cause of emphysema in cases where openings of the bone exist. Of the causes of these openings he thinks that defects of ossification are more common than remains of the mastoideo-squamous fissure, since the latter are for the most part only very narrow canals for the transmission of vessels through the bone.

Anatomy of the Petro-mastoid Portion.—According to Vrolik, the mastoid portion is formed of two independent processes of bone, one anterior and the other posterior. On the other hand, Joseph claims that it is only the external surface of the petrous portion. The writer argues with Vrolik, and describes an embryonic skull where these two processes were separated by a suture; also an adult skull where a suture separated the mastoid process with the external lip of the mastoid incisura from the posterior part of the mastoid bone with the internal lip of the incisura. The development of the mastoid bone has not been minutely described. In the new-born it exists as a spongy cap upon the bony arch which covers the external semicircular canal. The processus tympanicus squamæ which later becomes blended with the mastoid process, is, at the time of birth, partly united to it. The mastoid process grows outward and backwards at first, and later downwards. At the same time its form is changed by the outward growth of the temporal ridge whereby the upper wall of the external auditory canal becomes lengthened, the margotympanicus squamæ remaining in its original relation to the tympanum. By this outward growth of the squamous and mastoid portions the external wall of the skull is separated from the middle ear. That part of the squamous bone which in the new-born forms part of the wall of the mastoid antrum, grows downwards and backwards, thus covering a considerable portion of the antrum. It forms two-thirds or more of the mastoid process, but does not enter into the formation of its tip, turning forward at about the level of the lower border of the external auditory meatus.

The length of the mastoid process is obtained by letting fall a perpendicular line from its tip to the continuation backwards of the upper border of the zygoma. From the examination of a number of skulls at various ages it is found that its length averaged 7.5 mm. at one month, and 32.5 mm. at nine-

teen years, the most rapid growth being between the eighth and tenth months. The distance from the foot of the perpendicular described above to the stylomastoid foramen increases from 10.75 mm. at one month, to 26 mm. at nineteen years of age. Up to the fifth year this distance is greater than the length of the process.

The boundary points of the mastoid antrum on the external wall of the temporal bone in the new-born, are as follows: (1.) The apex of the angle formed between the temporal ridge, and its descending branch, previously described. (2.) The boundary point between the upper and middle thirds of the mastoideo-squamous fissure. (3.) The middle third of this fissure. (4). The site of the future mastoid process, already mentioned. (5). The descending branch of the temporal ridge; this bounds the antrum inferiorly. (6.) The margo tympanicus squamæ; this lies anterior, inferior, and exterior to the antrum. (7.) The posterior border of the annulus tympanicus; this lies inferior to the antrum. Through the direction of growth of the mastoid process downwards and backwards, the mastoid process, which in the new-born is in front of the plane of the posterior wall of the antrum, at the age of three to four years has its tip lying in this plane, and in adult life behind it. The boundary points for the determination of the position of the antrum in adults are: (1.) The angle between the temporal ridge and its descending branch, and particularly the spina supra meatum. (2.) The margo tympanicus squamæ, which at all ages preserves its original relation both to the tympanum and the mastoid process. Since the antrum always lies backwards and upwards from the posterior portion of the margo tympanicus, it is only necessary in seeking the antrum to regard the direction of the upper and posterior wall of the external auditory canal. (3.) The tangent drawn from the spina supra meatum to the posterior edge of the annulus tympanicus, is a boundary point of the mastoid antrum for all ages.

Changes in the Temporal Bone as Results of Rickets.—A. Openings in the Temporal Bone which are not Physiological.—Toynbee first pointed out such cases, and gives thirty-nine cases of openings through the upper wall of the tympanum. Several cases are mentioned by other writers of holes formed by atrophy of the bone about the sigmoid sinus. Bürkner found thirty-six cases of holes in the tegmentum tympani, four cases of gaps leading from the tympanum into the carotid canal, and three cases of openings into the jugular fossa. He also found in the squamous bone, just over the root of the zygoma, in a child a year and a half old, an area of bone 15 mm. by 6 mm., so thin that there was only a network of bone left. He is of the opinion that these appearances are caused by pressure of the brain, except where there are inflammatory processes. The author has never found gaps in the bone surrounding the middle ear in normal temporal bones of the adolescent, except when there were physiological defects of ossification, but such gaps are common in the temporal bones of rachitic children. These rachitic changes occur in almost all parts of

the temporal bone, except the walls of the labyrinth. The tympanic portion is rarely affected, as is also the upper wall of the auditory canal, but the anterior portion of the articular process and the glenoid cavity are frequently the seat of this process. It is highly probable that in those places where the bone becomes thinned up to the formation of foramina, a further extension of the process does not lead to the formation of bone, but the holes persist. Kiesselbach agrees entirely with Bürkner that the external cause of this formation of foramina is the pressure of the cerebral convolutions, but the slight power of resistance of the rachitic bone must be added as an internal cause. Luschka and Zuckerkandl think, however, that these changes are due to age.

B. Infractions of the External Table.—Another result of rickets of practical importance is a depression of the external table of the posterior portion of the squamous bone, as well as of the external wall of the antrum in the new-born. Bezold found three cases of this among one hundred skulls examined. In these cases the depressions were just below the temporal ridge and behind the spina supra meatum. The author found these depressions in the bones of children only when there was rickets. In extreme cases the whole area bounded by the temporal ridge, its descending branch and the mastoideo-squamous fissure, is deeply sunken. He thinks that these depressions, when found in adults, are always due to a pre-existing rickets, and that the deep gaps sometimes seen in the squamous portion of the mastoid process are the remains of depressions formed in the bones of rachitic children. Besides the other signs of rickets in these cases, there occurs with unusual frequency a depression of the middle cranial fossa, which is to be explained by the pressure of the cerebral convolutions on the extremely softened bone. Two cases in adults illustrating the most important of these anomalies are described. The cause of the depressions of the external table is plainly to be sought in the pressure of the ear upon the soft, thin bone.

It is evident that, in a practical point of view, the existence of such depressions and gaps must call for the greatest circumspection in the performance of perforation of the mastoid process.

The Ability to Hear the Deeper Musical Tones Observed in Persons Partially Deaf, and the Physiological and Diagnostic Importance of this Phenomenon. Lucæ: *Archiv für Ohrenheilkunde*, Bd. 15, 1880.—The author wishes to call attention to the aid to diagnosis which is given by investigating the power of perceiving tones of various pitch. Even in cases which by the ordinary methods of investigation are attributed to catarrh of the middle ear, it happens not rarely that there is a power of hearing low tones in striking contrast to the inability to hear high tones and ordinary speech. It is an important question in these cases how far we may be justified in diagnosticating disease of the labyrinth, and in excluding a coexisting disease of the sound conducting apparatus. With regard to the first point there can be

no doubt that complete loss of perception of high tones to which the normal ear is so sensitive, indicates disease of the inner ear; but it is different with those cases when the ability to hear high tones is poor only by comparison with the power of perceiving low tones. The writer thinks the piano unsuited for investigating this point, because its high notes have not the piercing intensity which should characterize them. He uses the physharmonika, whose upper notes are extraordinarily clear.

The following case is of particular interest, because the autopsy followed in eighteen days after the clinical examination.

Case.—The patient was a man of forty-five years, blind and deaf, and with gray degeneration of the spinal cord. Little could be learned about his history, as he could hear only when one shouted in his ear. He spoke like a deaf-mute, dwelling long on each word. Tested by the aid of the physharmonika, he heard the low tones below C much better than the high ones. The m. tympani showed thickened edges on both sides, and a slight rattling was heard on auscultation. After an air-douche the patient heard better. There was a severe laryngeal catarrh.

On autopsy there appeared the usual evidences of chronic catarrh of the pharynx and middle ear. The thickened border of the m. tympani was found to be due to a collection of mucus. The muscles and ossicles of the middle ear were not materially altered.

In the internal ear was a patch of sclerosis the size of a pea, on the roof of the vestibule on each side. Also a small patch behind the eminentia arcuata. Both internal auditory canals were narrow and the auditory nerves slender, but, in contrast to the gray-degenerated optic nerves, they were of normal appearance. The striæ acusticæ were almost entirely absent. In the left cochlea were many pigment-cells, numerous otoliths, sometimes in black clusters and also some small glistening corpuscles. The right cochlea showed a similar state of affairs. In the utricle and saccule on both sides were numerous black, chalky lumps, which gave out carbonic acid gas upon the application of acid. On the right side, where the chalky masses were less numerous, the nerve-fibres were plainly seen spreading out, and in the membranous canals were some appearances already described by the author as pathological (*Virch. Arch.*, Bd. XXXV., p. 481). The labyrinthine fluid was scanty on both sides. The base of the stapes was transparent as normal, and freely movable.

This case was observed in 1866, but Lucæ did not publish it at once, in the hope that a companion case might come under his observation. This hope has lately been realized, and an account of the second case will be given later. The case just given is of particular value because of the short interval which elapsed between the clinical examination and the autopsy. It is highly improbable that during this interval any further change took place in the labyrinth, particularly since disease of long standing was shown by the duration of the deaf-

ness, as well as by the chalky concretions and sclerosis found. These were probably due to an inflammation of the labyrinth during early life. An important point is the absence of gross changes in the auditory nerves with coexistent gray degeneration of the cord. This was observed also in two other cases examined by Lucæ. It is a question whether the association of chronic catarrh of the middle ear with a serious affection of the labyrinth was accidental. The gross changes in the vestibule explain the patient's difficulty in hearing ordinary conversation, while the absence of such gross changes in the cochlea accounts for his well-retained power of hearing musical sounds. Why he heard the low tones better than the high ones the writer cannot say. The greatly diminished power of perceiving high musical tones, and the mode of speaking like a deaf-mute, indicated a severe affection of the labyrinth, while on the other hand the *relatively* good perception of low musical tones did not exclude a disturbance of the sound-conducting apparatus. Deaf-mutes frequently respond to low musical notes, but much more rarely to high ones. One deaf-mute examined by Lucæ could hear low tones so well as to derive considerable enjoyment from hearing music.

A practical point to be derived from the case described above is that the patient heard better after the use of the air-douche. This should encourage the hope that even in such a severe case an improvement may be expected by remedial measures.

There is another class of cases, where there is a diminished power of perceiving high musical tones, while the ability to hear low tones remains normal. To determine whether the perception is normal the author uses tuning-forks, the high one tuned to a sharp of the fourth octave, the low one to the C of 132 vibrations. In making the investigation he follows the method of Von Conta, with this modification; then he compares the ear of the patient with his own ear. The observer must of course have normal hearing, and in view of the frequent difference between the two ears of the same individual, the same ear should always be used. In making the investigation the observer strikes the fork sharply and holds it close to the ear of the patient. As soon as the patient ceases to hear the sound, the fork is quickly placed near the ear of the observer, and the time noted which elapses before the sound becomes inaudible. It need not be said that it frequently happens that this period of inaudibility varies greatly for low and high tones with the same patient. For instance, a patient may hear the low tone as long as the observer, while the high tone is audible to the observer for ten or fifteen seconds after the patient has ceased to hear it.

When the low tones are heard normally and the ability to hear high tones and whispers is diminished, it is evident that disease of the sound-conducting apparatus may be excluded and an affection of the labyrinth diagnosticated. The writer has found this condition in cases where the evidence pointed to disease of the inner ear, as in deafness after meningitis, after stunning by a vio-

lent explosion, and after ringing in the head, both preceding hyperæsthesia of the auditory nerve and a still existing severe vertigo. Such cases strengthen the diagnosis in cases where no history of preceding disease can be obtained. In this class of cases the middle and external ears are usually intact so far as can be determined, but Lucæ has seen numerous cases of this kind where there were such lesions of the m. tympani as scars, thickenings, and concretions, which would ordinarily be considered as the expression of deeper disturbances of the sound-conducting apparatus. He has himself treated patients for chronic catarrh of the middle ear in whom he afterwards found that the ability to hear low tones was normal.

It could not be determined positively that these cases were due *solely* to disease of the labyrinth, except by proofs derived from pathological anatomy. Such evidence the writer obtained from the following case, which came to an autopsy six weeks after the clinical examination.

Case.—A woman, eighty-nine years old, had been run over by an omnibus eleven years before, and ever since had been partially deaf. With the right ear she could hear a whisper at the distance of 3 m. On the left side she could hear only when one shouted in her ear. With the left ear she did not hear a C^1 fork at all, but with the right ear she heard it normally. Both external auditory canals were free. The left m. tympani was much retracted and perforated near its border. On introducing a small rubber tube into the left external canal, and blowing through it with the mouth, the air escaped into the pharynx with a dry, hissing sound. On the right side nothing abnormal was discovered. Unfortunately, no examination was made with high musical tones. The autopsy was on the day following her death. The pia was found œdematous, and the brain injected; the ependyma of the fourth ventricle thickened, and the striæ acusticæ absent. Both petrous bones were much injected. The auditory nerves were slender, and of a gray color. On the right side the external and middle ears were normal. After removing the dura, the upper semicircular canal was partly exposed, owing to absorption of the bone. Advantage was taken of this to test the mobility of the sound-conducting apparatus, in a novel manner. After removing the anterior wall of the external auditory canal, blasts of air were directed against the m. tympani by means of a rubber bulb, and it was observed that the fluid in the labyrinth moved synchronously with the blasts of air. After removing the cochlea it was observed that the membrane closing the fenestra rotunda moved with the fluid of the labyrinth. Nothing abnormal was noticed in the labyrinth itself. Under the microscope the vestibular branch of the auditory nerve appeared normal, while the cochlear branch showed very thin, atrophied fibres, with marked destruction of their borders. In the left ear the external canal was free. Besides the changes observed during life the m. tympani was leathery, and completely united to the promontory. The tympanic cavity and mastoid cells were completely stuffed with the thickened mucous membrane, so that

the ossicles had to be dug out with the knife. The tympanic opening of the Eustachian tube was free. The labyrinth and auditory nerves showed the same appearances in general as on the right side, although here the vestibular branch also was attacked by atrophy. The nerves were examined while fresh.

It is unfortunate that in this case the ability to hear high tones was not investigated, yet it is presumable that it would have been found diminished, as is wont to happen in old age. The point of greatest significance in this case is that with such great diminution of the ability to hear a whisper, and with normal perception of low tones, such as existed in the right ear of the patient, there should have been found a normal sound-conducting apparatus, with disease of the labyrinth. It is certain that the group of nerve-fibres, among which were those fibres which belong to the tone C^1, were still capable of performing their function. Thus it is seen that with atrophy of the cochlear nerve a whisper may still be heard, though perhaps with diminished distinctness, while when severe disease of the sound-conducting apparatus coexists, as in the left ear of this patient, only shouting in the ear is audible.

With regard to the frequency of this phenomenon, the author found that, out of one hundred and seventeen cases examined, 41 per cent. heard the low tone C remarkably well, while 16 per cent. heard this tone normally. Another practical point to be observed is that the natural method of measuring the degree of deafness, *i. e.*, by speech, particularly with a single low sound, is not to be improved upon. The ticking of a watch, which is commonly used as a measure by aurists, is generally of so high a pitch that it does not always show the degree of deafness of the patient for spoken sounds.

Pulsation in the Membrana Tympani. Küpper: *Archiv für Ohrenheilkunde*, Bd. 15, 1880.—Wilde first pointed out that "when the membrana tympani is perforated the air or mucous cells in the opening sometimes pulsate synchronously with the heart-beat. This is seen particularly when there is a light coating of thin fluid at the bottom of the external auditory canal, and the cells by which the light is reflected are either in the opening or directly opposite to it." Schwartze described a case of pulsation in an unbroken membrane, the mucous membrane of the tympanic cavity being hypertrophied and the pulsation taking place in a spot about the size of a pin's head at the point where the tip of the cone of light naturally falls. In another case the appearance was seen in a much injected membrana tympani. Nor is this phenomenon confined to this locality, for Demarquay observed it in the fluid injected into a frontal sinus which had been opened on account of an abscess. The writer saw it in a patient whose tibia he had chiselled out on account of a necrosis. When the walls of the cavity in the bone were covered with abundant granulations, the drops of pus at the mouth of the cavity pulsated strongly.

Küpper explains this phenomenon as follows: When the systole of the

heart causes an increased pressure of arterial blood in a cavity filled with soft tissue, the calibre of the cavity is diminished, and the drops of fluid at the mouth of the cavity must change their place somewhat, returning to their former place in the following diastole, the light reflected from the concave upper surface of a drop showing its slightest movement. It is necessary for the production of this pulsation that the cavity should have stiff walls which yield so little as not to compensate for the increased quantity of blood. The membrane which covers the cavity must also have a large supply of blood. If a m. tympani whose mucous membrane is normal be perforated and the tympanic cavity filled with fluid, no pulsation will occur. A third requisite is that the mouth of the cavity should be relatively narrow.

It would appear that the presence of air would prevent the occurrence of this phenomenon, because air is so easily compressed. But the elasticity of air increases, as is known, up to a certain limit in direct proportion to its density. If, then, there be a cavity containing air compressed by an abnormal secretion, the occurrence of pulsation is possible if a thin elastic membrane at once closes the cavity and plays the part of a drop. This is the explanation of the pulsation observed in an unbroken membrana tympani.

Dr. Horatio R. Bigelow—*N. Y. Med. Record*, Jan. 17, 1880—in continuation of the subject of the anatomy and physiology of the chorda tympani nerve, discussed in the *Archives of Medicine* for June, 1879, draws the following conclusions: 1. The chorda tympani nerve is distinct and integral throughout its entire length. 2. It is derived from the nerve of Wrisberg, and not from the facial. 3. Its especial sensory function is derived from the ganglion upon the nerve of Wrisberg, into the granular protoplasm of which the ultimate fibrils may be traced. 4. The lingual branch of the fifth presides over general sensibility only. Isolation of the chorda tympani, as completely as possible, destroys the sense of taste in the anterior two-thirds of the tongue, the fibres undergoing degeneration. 5. Section of the lingual destroys sensibility, but only modifies the sense of taste, this modification being due exclusively to the branches from the chorda tympani. 6. Section of the facial, behind the origin of the chorda tympani, destroys the sense of taste *only after a lapse of time*, and this, not because the facial at this point contains gustatory filaments but because the nerve is cut off suddenly from its supply, and has received such a shock that it undergoes degeneration. If the chorda tympani be drawn out at the point where we first notice its filaments of origin, and divided, the sense of taste will be almost entirely destroyed. If the nerve of Wrisberg be cut in the aqueduct behind the ganglion, the sense of taste is lost. From which it may be inferred that the intermediary nerve is continued in the chorda tympani, and that this latter is a carrier of the sense of taste from the cells in the intumescentia gangliformis.

Mr. Brett—*Lancet*, Nov. 29, 1879—reports a case of rupture of the membrana tympani by blowing the nose. The patient was a man aged twenty-fonr years, who was suffering at the time of the accident from a bad cold. He was afterward unable to blow his nose without pressing his finger against the affected ear to keep the wind in.

Sclerosis of the mastoid process is regarded by Hartmann—*Archives of Otology*, Dec., 1879—as existing without demonstrable pathological causes, although there is a difference of opinion as to whether old age exercises any influence on the expansion or contraction of the mastoid cells. In seventy skulls of varying ages, the writer found but one pronounced hyperostosis of the mastoid process, and this on one side only, the other having air-cells. Inflammatory processes may spread from the tympanum to the mastoid process, and lead to hyperplasia of the bony foundation, and so to complete sclerosis.

Sclerosis is often encountered during operations on the mastoid, hindering penetration, and rendering an entrance to the antrum difficult. Considering the importance of sclerosis to our prognosis of the morbid process complicating inflammations of the middle ear, as well as in reference to operations on the mastoid process, the author thinks more attention should be given to its condition during post-mortems.

The writer divides sclerosis into two varieties; first, as idiopathic, chronic periostitis, and ostitis interna of the mastoid process, developing itself after the cessation of a tympanic inflammation; second, as a morbid process developing itself side by side with an inflammation of the tympanum, and then remaining stationary or advancing simultaneously with the advances of the latter.

The writer quotes Wendt's experience to establish the fact that the origin of the disease is an inflammation of the mucous membrane of the air-cells, leading to sclerosis of the bone. He further quotes from a review in *Archiv für Ohrenheilkunde*, VI. 293, which says that Dr. Wendt often found the cavities of the mastoid process quite abolished by reason of the swelling of the mucous membrane before death. The mucous membrane in these cases seemed to be tightly squeezed, a state that was probably accompanied by violent pains. In one case of acute purulent inflammation of the middle ear, the pains lasted for weeks, and being attributed to the mastoid region, where he expected to find pus, an operation was performed with Middeldorf's akido-peirastic drill. The cavities in the bone, such as they were, being opened, no pus was evacuated and there was no demonstrable communication between the wound and the tympanum. Hartmann considers that sclerosis is developed by such a morbid process as Wendt observed, and he regards it as analogous to the densifying ostitis of other bones of the body. He considers that to the persistent inflammation in the bone is due the anguishing pains sometimes experienced. He thinks that his operative experience proves that these pains are caused by the morbid

process in the mastoid region, and that a simple boring into the mastoid process, without opening a cavity or evacuating a secretion, can stop the inflammation and make the symptoms cease. The author sums up with the assertion that *Sclerosis can appear as an idiopathic disease of the mastoid process, after cessation of inflammation of the middle ear, and cause the most violent pains. Practice proves that the symptoms of violent pains, in connection with idiopathic sclerosis, can be relieved by opening the mastoid process.*

Sclerosis, as a complication of inflammatory processes in the tympanum, is illustrated by cases, but space will not permit their consideration here. The author regards the fact worth remembering, that in making an artificial opening into the mastoid process, we are not, as a rule, to expect to find any deposit of bone on the surface, and, therefore, we cannot penetrate deeper than the normal anatomical relations allow, if we would avoid opening the labyrinth, and wounding the facial canal, as was once practically done by Schwartze in penetrating 3 centimetres forward in a case of sclerosis. The writer coincides with Bezold in laying stress on the frequent occurrence of an excessive curvature of the sinus transversus, the wounding of which is of course to be avoided.

Dr. Thomas Barr showed to the Glasgow Pathological and Clinical Society, at its meeting, October 28, 1879 (*Glasgow Med. and Surgical Journal*, Jan., 1880), the left temporal bone of a young man aged seventeen, who died Sept. 20, 1879, after a fortnight's illness. The patient had suffered from a purulent discharge from the left ear, for about two years previous to his death. The discharge had generally an offensive odor, and was sometimes attended by pain. Dr. Barr saw the patient nine days before his death, on account of the running from the ear, and found him complaining of pain in the left side of the forehead; he was languid and drowsy. He had vomited three or four times slightly. A week before he had had aphasia. Examination showed a polypus to occupy the tympanic cavity, and the greater portion of the tympanic membrane was absent. An epileptic seizure occurred before death took place.

On post-mortem examination the left cerebro-sphenoidal lobe of the brain was found adherent to the bone beneath; its convolutions were flattened and partially obliterated; the brain substance was pulpy, and in its interior an abscess was found with contents of a dirty greenish, decomposing pus, which had an almost gangrenous odor. The abscess was lined by a layer of soft consistence, dark bluish in color. Over the temporal bone the dura mater was adherent, and of a blue color. At one place it was softened and destroyed, so that a probe could be passed directly into the petrous bone. There were two carious openings of considerable size in the bone; one was on the roof of the tympanum, the other in the groove, for the lateral sinus communicated with the mastoid cells.

Mr. Dalby's contributions to the Royal Medical and Surgical Society's Transactions for 1879 is on "Diseases of the Mastoid Bone." Mr. Dalby is of the opinion that probable fatal effects could, in many instances, be averted by perforating the mastoid cells. A case is cited, that of a woman aged thirty-two, where the tympanic membrane was accidentally ruptured with a hair-pin, and suppurative inflammation was thus established. A month later, after an attack of pain in the ear, there was facial paralysis of that side, and the tympanic cavity was found to be filled with a polypoid mass, the membrane having by this time quite disappeared. Removal of the polypus was followed by relief of the pain.

Some weeks later, however, the patient again came to the hospital, when it was ascertained that, two weeks before, the swollen skin over the mastoid broke down and a little bloody matter was discharged. A ragged wound was the result, from which escaped a quantity of watery, very foul-smelling discharge. The skin over the mass was bluish, the tissues were infiltrated, and the edges of the wound were everted and hard.

The disease was regarded as malignant, although there were no enlarged glands nor any history of cancer in the family. The surface of the bone was exposed but no loose bone was detected. From this time on she wasted rapidly and the wound increased in size until it formed a large cavity discharging most offensive matter, and she died from exhaustion without any head symptoms or hæmorrhage. The entire duration of the disease was eight months.

At the post-mortem no disease was discovered beyond that of the tumor itself.

The ulcer was nearly circular and had a diameter of three inches. A funnel-shaped hole, two inches in diameter, extended forward and inward to a depth of two inches in the direction of the long axis of the petrous bone, terminating close to the lining membrane of the mouth, just internal to the inferior maxillary articulation. The surface of the cavity was foul, dirty green in color, and partly formed by the white necrosed remains of the petrous portion and the sloughing cartilage of the jaw.

The ulcer's border resembled proud flesh in color. The surface was irregular and knobby, especially at the lower part where there was much fibrous and œdematous thickening. No distinct tumor was made out. The bone was extensively destroyed and absorbed. The mastoid process, the external meatus, and tympanum, as also parts of the petrous portions of the temporal bone, had entirely disappeared. The intracranial surfaces of the petrous portion were normal, but after stripping off the dura mater, it was found that the jugular foramen had become enlarged by ulceration. The articular surfaces of the inferior maxillary were exposed. The squamous portion was eroded by the extension, over a part of its surface, of the granulation tissue.

Under the microscope, the diseased tissue eonsisted mainly of vaseular meshes eontaining numerous small cellular islands, the smallest of these groups, eonsisting of from four to six eells, presented ill-defined charaeters and intermediate forms between epithelial cell and fibre. The larger groups were plainly epithelial; no intercellular substanee intervened between the cells; the eells had a large oval nueleus contaiuing nucleoli or granules, and otherwise resembled epithelial eells. A few birds' nests were found.

In the six cases of malignant growth of the mastoid whieh Mr. Dalby has collected, with but one exception, a suppurative eondition of the tympanic cavity, of greater or less duration, was the original souree of irritation; and he considers that these malignant growths resemble other morbid growths of the middle ear, in arising from the mueous membrane lining the tympanum during a state of chronic suppuration.

Mr. Dalby considers that the mastoid cells occasionally become primarily inflamed, whilst throughout the whole eourse of the inflammation the tympanic cavity remains healthy; although in general the eontrary is the faet. He believes that in these eases we should, usually, provide a means for the escape of the pus within the mastoid eells, by means of an artifieial opening down into the cells through the mastoid proeess. The author leans very deeidedly toward the more frequent performance of this operation than generally prevails.

No absolute rules for guidance are laid down, but when acute suppurative inflammation of the middle ear is aceompanied by long-continued and severe pains in the mastoid, and there is much tenderness on pressure, he considers the operation imperative.

Mr. Rudd Leeson, in *The Lancet* of Dec. 6, 1879, reports a ease of ehronic bronehitis, that had been very persistent, the cough being especially severe in the morning, and which had resisted all treatment. She had been suffering from this eomplaint for several years when she began to grow deaf, and in about two years she had almost lost her hearing on one side. The other ear becoming affeeted, she eonsulted Mr. Leeson for the deafness. On examination, both ears were filled with iuspissated cerumen, which with considerable difficulty was removed.

From that day she entirely lost her cough and sickness, and appeared indeed to be quite another woman.

Dr. Theobald, in the course of some remarks made before the Baltimore Clinieal Soeiety, on Foreign bodies in the external ear (*Maryland Medical Journal*, Feb., 1880), drew attention to an excellent probe for the removal of foreign bodies, that eould be made out of a fine English hair-piu; he prefers it to any instrument in use for that purpose. Several eases were reported in which its use was demonstrated. Dr. T. gave an account of one case of par-

ticular interest: an insect having entered the ear, the advice of a country practitioner was sought, and he poured melted cerate into the meatus, with a view to the insect's destruction. This hardened on cooling and was not re moved without considerable difficulty. The insect was found embedded in the cerate.

Report of the Policlinic for Aural Diseases in Göttingen. Dr. K. Bürckner: *Archiv f. Ohrenheilkunde*, XVI., 1 and 2.—The results are given as follows for 1879:

Well	148 or	45·2	per cent.
Much improved	69 "	21·0	"
Unimproved	18 "	5·4	"
Not treated	23 "	7·1	"
Result unknown	42 "	12·8	"
Died	1 "	0·3	"
Still under treatment	27 "	8·2	"
Total	328 "	100·0	"
Males	212 "	·64·6	"
Females	116 "	35·4	"
Children	94 "	29·9	"
Adults	234 "	71·1	"

Analytical tables of the different diseases are given, showing:

Diseases of the external ear	81
" " mem. tympani	17
" " middle ear	198
" " inner ear	17
Various	15
Total	328

Disease of both ears was found in	229 or	63·8	per cent.
" one ear, " "	130 "	36·2	"
" right " "	47 "	36·1·	"
" left " "	83 "	63·9	"

In subsequent remarks, several of the more important cases are described, which, although of interest, offer nothing absolutely new. Boracic acid is spoken very favorably of, especially in the treatment of eczema and tympanic suppuration. It was used for eczema as a salve, 2·5—5 ad 20—30 vaseline; for suppurative inflammation as a solution and in powder.

Report of the Policlinic for Aural Diseases at Halle, a. S. Dr. Hugo Hessler: *Archiv für Ohrenheilkunde*, XVI., 1 and 2, p. 68.—The report

includes a spaee of eight years from 1871 to 1879. The results of treatment are given as follows:

Well	1,071
Much improved	183
Unimproved	79
Not treated	93
Result unknown	770
Died	10
Total	2,206

To which are added:

Results of old disease	141
No diagnosis	47
Total	2,394

Disease of the external ear	578
" " middle "	1,659
" " inner "	112
No diagnosis	47
	2,394

Analytical tables of the diseases are also given. This summary report for the whole time is followed by a more minute report of the cases of the last year as follows:

Well	202
Improved	50
Unimproved	35
Not treated	19
Result unknown	76
Died	2
	384
Results of previous purulent inflammation	24
No diagnosis	10
Deafmutism	2
	420

The operations were as follows: incision of the meatus for abscess with caries, periostitis of meatus, and furuncle, 15 times; removal of foreign bodies, 8, three of which were removed by foreeps, and five by the syringe; paracentesis of the drum-membrane, 28; extirpation of polypi, 12; tonsillotomy, 7; Wilde's incision, 6; perforation of the mastoid, 7.

There were, rupture of the drum-membrane, 6 cases; simple acute catarrh of the middle ear, 34, of which were discharged well, 28; simple subacute catarrh 27, 20 in one and 7 in both ears, of the former of which 15 were discharged well and 2 improved, of the latter 1 well and 2 improved; simple chronic catarrh of the middle ear 69, 6 of one and 63 of both ears; of these 2 were discharged well and two improved, and 6 well and 23 improved respectively.

There were found, of stenosis of the Eustachian tube, 5 instances, 2 in one and 3 in both ears. Acute purulent inflammation of the tympanum 41, 27 in one and 14 in both; of the former 19 were cured, 7 no record, and 1 died from meningitis. Chronic purulent inflammation of the tympanum, 85, 57 in one and 28 in both; complicated with caries in 12, with necrosis in 2, with polypi in 24, and with facial paralysis in 1; of the 57 were cured, 21; improved, 12; unimproved, 8; not treated, 1; not recorded, 15; of the 28, were cured, 10; improved, 6; unimproved, 4, and not recorded, 8.

Nervous deafness was observed 24 times: 11 in one and 13 in both ears. Of the former, trauma was the cause in 6; concussion from explosion in 2; syphilitic infection in 1; so-called Ménière's disease in 1; and unknown cause in 1. Of the latter the cause was syphilitic infection in 5; meningitis cerebro-spinalis in 2; unknown, 2; typhus, 1; trauma, 1; brain-disease, 1; Ménière's disease 1. Of these were cured, 3, where syphilis was the cause; improved, 2; unimproved, 3; untreated, 7; result unknown, 8; died from peritonitis, 1.

Report of a Policlinical and Private Practice in Basel. Prof. Dr. Alb. Burckhardt-Merian: *Archiv für Ohrenheilkunde*, XVI., 1 and 2, p.84. —This report is for five years, from 1874 to 1879. The results of treatment are not given.

Males	1,282	or 54·56	per cent.
Females	1,068	" 45·44	"
Total	2,350	100·00	"
Disease of right ear	487	" 20·73	"
" " left "	597	" 25·40	"
" " both ears	1,266	" 53·87	"

Age.	*Cases.*	*Per cent.*
0—1	22	0·94
2—5	152	6·46
6—10	207	8·80
11—20	448	19·07
21—30	425	18·08
31—40	402	17·11
41—50	324	14·22
51—60	202	8·60

Age.	*Cases.*	*Per cent.*
61--70	125	5·32
71--80	36	1·10
80--	7	0·30
Total	2,350	100·00

Diseases of the external ear	720	or 30·65	per cent.
" " " middle "	1,459	" 62·10	"
" " " inner "	171	" 7·25	"
	2,350	100·00	"

Analytical tables of the various diseases follow.

Pólipo celulo globular del disco Timpánico.—Utilidad diagnóstica y terapéutica del ácido crómico. Dr. Suñé y Molest: *Revista de Ciencias Médicas. Revista de Med. y Cir. Prácticas*, Madrid, May 7, 1880.—The case reported is that of a man 30 years of age, who had been suffering for eighteen days previously with intermittent pain referred to the depth of the right ear; the hearing in this ear had been almost completely lost, and during a year previously the patient had been testing the skill of various empirics and had had various powerful remedies applied. Examination revealed at the inner end of the canal, and completely covering the membrana tympani, a reddish mass, yielding under the probe; the contiguous lining of the canal was excoriated and there was an abundant offensive discharge. To further investigate the character of the growth, as well as for the purpose of treatment, chromic acid was lightly applied, without provoking pain or other unpleasant symptoms. On the following day the hearing had improved, and a portion of the membrana tympani was visible; the application of the chromic acid was continued for eight days, when the remainder of the growth, which had retained its globular form, came away on syringing.

The hearing was immediately improved, and the patient made a good recovery without further treatment.

Exfoliation of almost the entire Temporal Bone, the Result of Necrosis; Recovery. Dr. J. Gottstein: *Archiv für Ohrenheilkunde*, XVI. Bd., erstes u. zweites Heft.—Cases of removal of the necrosed cochlea, with and without the semicircular canals, have been frequently reported, also a few of the pars petrosa of the pyramid, and Gruber has lately reported one of removal of nearly the whole mastoid process. Gottstein now reports a case in which the necrosed bone removed consisted not only of the mastoid but also of the osseous tympanum, with the osseous Eustachian tube, a portion of the squamous bone, the anterior and posterior walls of the pars petrosa, with the

cochlea and semicircular canals. The previous history of the patient, a child eighteen months old, showed clearly that extensive disease of the right middle ear and adjacent parts must have existed since the time when she was only six months old. There had been a constant discharge from the ear, and on several occasions an abscess in the right mastoid region had been opened with the knife. As the mother could see no abatement of the otorrhœa, she became dissatisfied with the physician who had thus far managed the case, and decided to let the ear take care of itself. A swelling, however, soon again developed behind the ear, and on the 26th of Augnst, 1879, the mother brought the child to Dr. Gottstein for treatment. Its appearance was then decidedly cachectic, and, furthermore, there was well-marked paralysis of the right facial nerve. Behind the ear there was an abscess as large as an English walnut. It had already broken, and through the small opening in the skin a sharp end of bone projected. Dr. G. enlarged the opening and removed with ease a large mass of bone, which will be described in detail farther on. On cleaning out the cavity of the abscess, the doctor observed that some of the water escaped from the external auditory canal. Under the employment of antiseptic dressings the cavity of the abscess closed in a few days, and the discharge from the meatus ceased. When the child was seen by Dr. G. in the month of October, five or six weeks after the removal of the sequestrum, very marked improvement in its general condition had already taken place. There had also been no return of the discharge. The right mastoid region was found to be flatter than the left, but it did not appear to be tender when pressure was made upon it. The parts beneath the skin felt hard, and there were only very slight unevennesses. On inspection, no definite landmarks could be made out in the middle ear. The external meatus presented no recognizable defect. The distortion of the child's face still remained.

The mass of bone removed from the cavity of the abscess presented an irregular appearance. It measured 3·3 ctm. in breadth, 1·8 ctm. in height, and 1·4 ctm. at its point of greatest thickness. On comparing this bony fragment with a normal temporal bone, Dr. G. found that it consisted of a part of the squamous portion, almost the entire mastoid portion, the roof or upper wall of the cavity of the tympanum, the annulus tympanicus, and the entire anterior, lower, and posterior parts of the pyramidal portion. Examining each of these more closely, he found, in the first place, that the caries had destroyed the outer cortical layer of the upper part of the rudimentary mastoid process, thus leaving the air-cells exposed to view. On the inner aspect of this bone the cells were also similarly exposed to view. The caries had destroyed only the lower border of the annulus tympanicus; in other respects it was perfectly intact. The membrana tympani and ossicles had disappeared. The fenestra ovalis still displayed perfect outlines, but the foot-plate of the stirrup, with its surrounding membranous attachments to the oval window, was, of course, lacking. The promontory, the fenestra rotunda, the rostrum cochleare, the

semicanalis pro musculo tensore tympani, and the entrance to the osseous portion of the tube, were all easily distinguished. The thin, gutter-like septum of bone—the septum canalis musculo-tubarii—which separates the two last-named canals from each other, was also easily traceable to its inner end on the pyramidal part of the temporal bone. Posteriorly and superiorly the broad cavity of the mastoid antrum showed comparatively slight traces of caries. On the other hand, the pyramidal portion proper seemed to be split by the destructive process into two portions throughout its entire length, from the prominentia pyramidalis to its extreme inner point. The exfoliation of the outer portion had left the cavities of the labyrinth exposed to view. Strange to say, the tegmen tympani was still in situ, and showed no evidence whatever of being affected by the carious process. The Fallopian canal seemed to be free throughout its entire length, from the hiatus canalis Fallopii to the orifice of the stylo-mastoid foramen.

Gottstein expresses the view that a "proliferative periostitis" must have taken place pari passu with the carious process, and that in this way an adequate support was probably prepared for the soft parts, which would otherwise have been left exposed.

An Unusual Development of Osteophytes in the Temporal Bone. Dr. E. Zuckerkandl: *Monatschrift für Ohrenheilkunde*, XIV., No. 3.—In the right temporal bone of a man there were found numerous osteophytes over the external surface of the mastoid, in the incisura mastoidea, in the fossa sigmoidea, on the walls of the meatus, and around the exit of the Fallopian canal. They were white, reticulated, and those in the sigmoid fossa were perforated with holes which communicated with the interior of the mastoid. On opening the mastoid all of its cavities showed the bone paler than normal, due to a development of newly-formed osteophytes, which covered all of the depressions and prominences of the cells and their septa. These were not smooth but covered with holes and depressions, giving them a sponge-like appearance.

In a second case of caries of the mastoid, with perforation into the skull and into the fossa jugularis, all of the pneumatic cavities except the tympanum contained an abundant formation of osteophytes.

The Pathology of a Case of Fatal Ear Disease. P. McBride and Alexander Bruce: *Jour. of Anatomy and Physiology*, April, 1880.—The case here reported jointly presents sufficient points of interest, and is, in the manner of its presentation, so clear and full that the reviewer feels justified in reproducing it, not in the form of a review, but very nearly at length. The subject, a woman, was a patient in the Edinburgh Royal Infirmary, and was seen by Mr. McBride but once during life, and then but three days before her death, at which time she was able to give intelligent answers to questions. Clinical facts being out of place in a report of this character, they are omitted by the writers except where allusion to them is absolutely necessary.

The case was evidently one of long standing suppuration of the right middle ear, perforation of the tympanic membrane and retention of masses of thickened pus, with considerable deafness on the same side. On the other side the hearing was normal. The tuning-fork, when placed on the forehead, was heard best in the deaf (diseased) ear, thus showing that three days before death the right auditory nerve and labyrinth were healthy.

The right temporal bone was removed and carefully examined, but not a trace of caries or necrosis could be found. The only abnormity (if, indeed, it may be so called), was, that the hiatus Fallopii was somewhat larger than usual, and the large petrosal nerve which passes through it gave way on very slight traction.

The next step in the dissection was to chisel away the roof of the tympanum. When the tegmen tympani was removed the tympanum seemed to be filled with a yellowish-white cheesy material, having the consistence of clotted cream. The chisel was then carried through the roof of the mastoid antrum, which was also seen to be packed with the same caseous material. Microscopic examination showed the latter to consist of pus corpuscles in all stages of degeneration, oil globules, a considerable number of cholestearin crystals, rod-shaped bacteria, and some large epidermoid-looking cells. According to Von Troeltsch, these large, flat, squamous cells occasionally occur in the mucous membrane of a normal mastoid antrum. Having studied the nature of their cheesy contents, the tympanum and mastoid antrum were washed out to see the condition of the mucous membrane lining them. That of the tympanum was found to be enormously thickened, so as to fill up a part of the cavity. Microscopically, the thickening was found to be due to increase of the connective-tissue elements. The lining of the mastoid antrum was also thickened, but still smooth and glistening.

Of the membrani tympani only a small portion at the edges was left. All the ossicles were absent with the exception of the foot-plate of the stirrup, and this was afterward dissected out from the fenestra ovalis. Neither the tensor tympani nor the stapedius was visible.

It was next desired to find out the condition of the mastoid cells proper; for this purpose the mastoid process was sawn through in various directions. Instead of the ordinary cellular structure the whole was found to consist of dense ivory-like bone. Portions of this were prepared and cut into sections. Under the microscope these revealed the ordinary structure of compact bone; the Haversian canals were not very numerous, but at parts there were spaces of various size filled with reticular tissue; it differed from that usually found in diplöetic spaces, in that it was much denser and altogether had a more organized appearance; its meshes contained no fat. This tissue was carefully examined at its margins to see if there was any tendency to a development of new bone, but such was not found to be the case.

The external part of the tympanum, etc., was then removed so as to leave that portion of the petrous bone which contains the cochlea, vestibule, and semicircular canals. This was then divided into two parts in the direction of the axis of the external auditory meatus. By this means the vestibule was opened into. In it was seen a whitish material, which, on being examined under the microscope, revealed pus-cells and oil-globules. The two portions of bone, containing respectively the semicircular canals and the cochlea, were then prepared and cut into sections.

Those of the cochlea seemed to show a complete disorganization of that delicate organ, and the presence of a small quantity of granular débris with one or two leucocytes. I say, seemed to show, because the cochlea is difficult to prepare, and in the study of its morbid anatomy one can afford to place more reliance on positive than on negative results. In the sections of that portion of bone containing the semicircular canals no good section of a membranous canal was obtained except at the ampullæ.

The sections, however, revealed a most interesting state of things. The whole portion of bone was infiltrated with bacteria. The preparations which showed this best were those which had been stained first with osmic acid and afterward slightly with picro-carmine. On examining the surface of the bone generally it was seen to be crowded with rod-shaped bacteria. These were abundant both on and between the lamellæ. The perivascular spaces (the probable lymphatics) of bone were uniformly full of them. In the coats of the larger arteries they were seen, and also around the margins of their lumen. In some of the preparations longitudinal sections of the Haversian canals were obtained with a contained vessel. On and around the vessel, rods were seen in great abundance. The veins, which were distinguished by their thin walls and irregular lumen, for the most part contained plugs, which on close inspection were distinctly seen to be made up of enormous masses of rod-like bodies. In sections of that part of the temporal bone containing the semicircular canals we meet with numerous spaces, empty for the most part, but some of which contain a reticulum, with vessels, fat, and leucocytes. In those spaces which contained diplöe the bacteria were present in great abundance; but in the empty spaces a few only were present round the edges. The same applied to the bony canals. In many of these specimens a transverse section of the facial nerve was obtained. Some of the organisms evidently had passed through the sheath, and could be seen lying between the nerve-fibrils. In some of the preparations some glistening masses of micrococcus were seen, but they were few in number.

The Cerebellum (by Alex. Bruce).—An abscess the size of a large walnut was found in the right lobe of the cerebellum toward the outer half. It was filled with green, viscid pus; large numbers of punctiform hemorrhages were found round it. The wall was ragged and the pus particularly fetid.

The cerebellum at this part was adherent to the posterior aspect of the tem-

poral bone, one-half inch outside of, and one-quarter inch below the internal auditory meatus, and the nerve entering the latter seemed to be uninvolved at the point of contact of abscess and bone. The dura mater had sloughed; the other parts of the brain were normal.

The fetid odor of the pus was explained on microscopic examination, scrapings of the pus being found to contain great numbers of rod-like bacteria, similar to those found in the petrous temporal bone and glistening granular bodies, which resisted the action of glacial acetic acid, and which were probably micrococci.

The hemorrhages described varied in size up to the head of a small pin: most of them were circular in form and nearly all had a light centre surrounded by a rust-colored ring. In the light centre, in some instances, the walls of a light vessel could be seen; the rust-colored ring was composed for the most part of closely aggregated red corpuscles, which were also infiltrated for some distance into the surrounding tissue of the cerebellum. In several instances where a longitudinal section of a vessel was obtained, the lumen of the vessel was seen to be completely occluded by blood corpuscles, while the perivascular lymphatic space was distended by white corpuscles, either leucocytes or pus-cells, aud intermixed with a few white corpuscles. Search was made, by clearing up some of the sections with glacial acetic acid, for the presence of bacteria or micrococci, but though there were found several glistening granular bodies resembliug those iu the pus and described as micrococci, they were too sparsely distributed to enable us to pronounce with any certainty as to their exact nature. In one instance only one distinct cluster of rods was seen in the perivascular space, and a considerable number of isolated granules, apparently micrococci.

In the neighborhood of the occluded perivascular spaces, the tissue of the cerebellum was infiltrated with leucocytes. The mode of production of these appearances would seem to be somewhat as follows: the bacteria, on reaching the dura mater, probably set up a localized meningitis, and shortly after, or coincidently with that, iufected the cerebellum itself, setting up a septic inflammation which ended in the formation of the fetid abscess above described, and in the sloughing of the dura mater. The channel of infection of the substance of the cerebellum is probably the perivascular lymph space and not the blood-vessels. Although in one instance only bacteria could be detected in these spaces, yet the occlusion by leucocytes of the lymph spaces seen on longitudinal sectiou of the vessels, can only satisfactorily be accounted for on the hypothesis that the irritation travelled along them. This occlusion would probably have resulted in the formation of a thrombus in the vessel, and from the increased pressure thrown upon the collateral vessels in the punctiform hemorrhages already described. These, together, would lead to the malnutrition aud abscess formation in the brain substance; and had the patient lived longer

we might expect the changes at the seat of hemorrhage to have gone on to the formation of a second septic abscess similar to the first.

Sur un Mode de Traitement de certaines Surdités et Surde-Mutités Infantiles. M. Boucheron: *Comptes rendus de l'Acad. des Sciences.* Paris, 29 Mai, 1880.—Setting aside the cases of deafness and of deaf-mutism resulting from arrest of development and from diseases of the internal ear, the author draws attention to the effect produced in the causation of this disability by the common catarrhal affections originating in the nasal and naso-pharyngeal mucous membrane in infants whose parents and grandparents are subject to naso-pharyngeal catarrh, and, after describing the course and symptoms as at present understood, lays particular stress upon the importance of thorough and patient treatment in these cases, and advocates strenuously the use of the Eustachian catheter and direct applications to the naso-pharyngeal mucous membrane. To accomplish this purpose the author employs anæsthesia by the method of Saint Germain, by which he claims that infantile chloroformization is both rapid and harmless, two or three inspirations being sufficient. A catheter of special curve is employed and the application repeated, under chloroform, two or three times a week until the desired effect is produced. No ill effect has yet been observed from the continued use of chloroform, it having been administered during a period of six months in one case, that of a little girl, without effect upon the general health.

Left Facial Paralysis. Tumor near Parotid Gland, probably Syphilitic. Improvement under Iodide of Potassium and Faradization. McCall Anderson. Service at the Western Infirmary: *The Glasgow Medical Journal*, April, 1880.—The patient's age was 48; he was admitted to the infirmary in February, 1880, suffering from paralysis of the left side of the face. There was also a firm tumor near the parotid gland of the same side. His health previous to his admission had been pretty good, although for the last five or six years he had had bronchitis during the winter months. At the age of nineteen he is supposed to have had syphilis. About six months before his admission, he observed a dark spot behind the ramus of the jaw, which gradually enlarged, but again subsided under the external use of iodine. Shortly afterward, however, the swelling began to spread forward on the face, in the region of the parotid gland, until it extended from a little behind the ear to halfway between the ear and the nose, its most prominent part being about an inch above the normal level of the cheek. The submaxillary glands were unaffected. The paralysis of the face was first noticed by him about a month before his admission, at first, slight in degree, but gradually increasing, until it became complete. At this time he began to suffer also from severe neuralgic pain, starting from the right side of the head, and extending round to the left, and also affecting the tumor.

On admission, the fulness of the cheek from the tumor, and the marked paralysis of the left side of the face, were striking. The tumor was firm, nodulated, and painful. The paralyzed muscles failed to respond to the faradaic current; but on the application of a feeble continuous current, contraction took place to a greater extent than on the sound side. Hearing was found to be very defective on the left side, not from disease of the middle ear, but owing, it was supposed, to the pressure of the tumor, which partly closed the external auditory meatus. That some congestion of the middle ear was produced by the pressure of the tumor, seems probable. The facial paralysis was also explained by the pressure of the tumor on the facial nerve. Other symptoms, such as sometimes occur in connection with facial paralysis arising from disease of the middle ear (anomalies of taste, etc.), were absent in this case.

Dr. Anderson diagnosed the case as syphilitic, and ordered 10-grain doses of iodide of potassium (*ter in die?*), under which treatment, in ten days' time, the pain in the tumor rapidly subsided, and its size was much diminished, there remaining only a broad ridge of transverse thickening, midway between the ear and the angle of the jaw. The hearing (rather indefinitely stated) was about as good on the left as on the right side. The paralysis was somewhat relieved. Subsequently, the patient was reported as improving, and the daily faradization of the paralyzed muscles had been commenced.

Anatomy and Physiology of the Chorda Tympani Nerve. Horatio R. Bigelow: *Brain*, April, 1880.—This contribution is intended to express more fully the author's views than has been done in his communications, which have appeared during the past year in the *Archives of Medicine* and the New York *Medical Record*. A review of the paper in the first-mentioned journal appeared in the American Journal of Otology for January, 1880.

The author's conclusions are, (1) that the chorda tympani nerve is not a branch of the facial, and, (2) that although the nerve of Wrisberg may arise in the *sensory* gray column of the medulla, he by no means concedes that the proposition that it derives its sensory functions from its central connections is absolutely demonstrable. In reference to the functions of peripheral ganglia, situated upon sensory nerves, the author says: "I do not maintain that the intumescentia gangliformis in question is capable or originating the sensory function, although in some cases of paralysis it would seem to possess such a power; but one of my experiments has demonstrated that it does act either as a storehouse or as a generator." (See also the review on p. 224.)

The Lancet, May 15, contains the report of a fatal case of suppurative otitis, under the care of Dr. James Allen, at the Wandsworth Infirmary. The patient was a woman aged nineteen, who was admitted on the 6th of January, 1880, and died on the 10th.

As an out-patient, she had received previous to her admission some drops that were to be put in the ears for deafness, which was so great that she had recently been obliged to give up her work as a domestic servant. The composition of the drops is not alluded to, nor is there any statement respecting the character of the aural disease other than the deafness, to which allusion has been made above. Owing to the pain being increased by the drops, they were discontinued. Intense headache and vomiting soon followed, and the former symptom persisted. The patient's previous condition had been bad, and there was a family history of phthisis. Symptoms of cerebro-spinal meningitis now set in and she was admitted to the infirmary.

At the necropsy the pathological characteristics of cerebro-spinal meningitis were present, with the exception of the presence of lymph and pus, both of which were absent. The symptoms of pyæmia were present, with one striking exception, namely, the absence of sweats. The examination showed, as far as the ears were concerned, that on the anterior surface of the petrous portion of the right temporal bone, near its base and upper border, a rounded tumor the size of a small hazel-nut presented itself on removal of the brain, not adherent, but indenting slightly the lower surface of the right temporo-sphenoidal lobe, and at this part there was slight limited softening of the brain tissue. The tumor was due to a collection of pus between the dura mater and the bone; there was also a small blood clot. An examination of the middle ear showed that the membrana tympani and ossicula were absent. The middle ear and mastoid cells were the seat of suppuration; this condition was still more marked in the inner ear, and the surrounding bone was infiltrated with pus. An intracranial abscess could be seen situated chiefly over the tympanum. On the left side there was suppuration of the middle ear alone, with perforation of the membrana tympani and absence of the ossicula auditus, except the stirrup.

The right pleural cavity contained ten ounces of blood-stained serum. The under lobe of the right lung was hepatized, and at its base there was a circumscribed empyema, containing about two ounces of fœtid pus, all arising from a small abscess on the lung surface. On the base and posterior border of this lung there were found several similar superficial purulent collections, but over these the pleura had not given away. Various stages of suppuration existed in the left lung, and the abdominal viscera were in a more or less abnormal state.

Mr. Frederic S. Eve reported to the Clinical Society of London (*Medical Times and Gazette*, March 27, 1880), a case of fracture extending through the temporal bone. The injury occurred to a boy aged thirteen months who fell off a bed and struck his head against a mangle. On his admission to St. Bartholomew's Hospital, he was insensible, vomited, and there was bleeding from

the right ear. The next morning there was a profuse discharge of clear watery fluid from the ear, which continued until he died, on the third day after the accident. The post-mortem examination revealed the presence of lymph in the sub-arachnoid space over the whole surface of the brain, but most abundantly over the right hemisphere. A fracture passed vertically through the squamous portion of the temporal bone and the petrous bone, cutting across the external and internal auditory meatuses, and terminated at the foramen lacerum posterius. A colored injection thrown into the external auditory meatus passed out through the internal meatus issuing from within the sheath of the nerves, thus demonstrating that the watery discharge in this case was the cerebro-spinal fluid.

The Lancet, March 6, 1880, contains the report of a case of fracture through the base of the skull with bleeding from the ear, by Mr. Harry Lupton. A woman fell from the top to the bottom of the stairs, falling with great violence on the top of her head. She soon recovered consciousness, and became greatly excited in her manner: it was also noticed that she was bleeding rather profusely from her right ear. She was put to bed and had applications of ice to the head for the next twelve hours, during which time she was alternately drowsy and wandering, but on the whole seemed more comfortable than could have been expected. The pupils acted under the influence of light, and the tongue was protruded without deviation toward either side, but she complained of great frontal headache. Oozing from the ear continued, but the quantity was diminished. On the second and third days there was continued improvement under the use of bromide of potassium fifteen grains, solution of acetate of morphia thirty minims, and syrup of oranges twenty minims, in one ounce of water, three times a day. The patient gradually improved until the sixth day, when convalescence seemed to be fairly established, although for six weeks, about which time she was last seen, she was easily fatigued, and subject to headache if she attempted prolonged conversation; she complained that her memory was much impaired.

In his remarks on this case Mr. Lupton considered that he was justified in regarding it as a case of fracture through the base of the skull, although the symptoms were less severe than were usually met with in cases of this grave injury. First, the stream of blood issuing from the ear immediately after the accident was much too large to have come from any of the vessels of the auditory canal; it flowed in a slow and regular stream of almost half the breadth of one's finger. Second, the fluid which ran from the ear during the first two days after the accident was not pure blood, but a mixture of blood and a thinner, more serous fluid, and this in sufficient quantity to wet several towels during the day. Third, her present state, the readily induced headache, and the impaired memory.

Mr. Gardner Brown (*Lancet*, March 13, 1880) reports a case of ivory exostosis, deeply seated in the external auditory meatus, which he removed with drills fitted to an American dental engine. The patient was a gentleman aged forty-five. He had during the past fourteen days experienced a very uncomfortable sensation in his left ear, with accompanying deafness. He was the more alarmed at this because he had suffered an impairment of hearing on the left side from an attack of measles in childhood.

In the right ear was found, deeply seated, an exostosis, spheroidal in appearance and almost filling the meatus. The removal of a small quantity of cerumen by syringing improved the hearing.

Further investigation proved that the exostosis was attached by a broad base to the posterior wall of the osseous meatus, its attachment measuring about six millimetres from above downward.

A fine wire loop (No. 28) was with some difficulty passed over and around the growth. It was, however, too sensitive to bear much examination, as the soft tissues were much congested. Touched with a probe the growth was extremely hard, very dense, and tightly covered with a pale, thin membrane. The growth appeared to be somewhat sessile or subsessile; after extraction, however, this proved true only of its outer portion. The shape of the growth was mammilliform, with its axis inclined forward and outward. In the left ear were found two exostoses growing from the anterior and posterior walls respectively, but situated near the outer part of the osseous meatus, and entirely preventing any view of the membrane. The growth in the right meatus was removed first, the patient being under an anæsthetic. The periosteum was cut through and torn away, and drills made to enter the centre of the growth to the extent of six millimetres, two different drills being used. Into the hole thus made a screw-top was now firmly fixed, to be used as a lever in breaking off the growth after its base had been perforated by drilling. Three separate holes in the base were made, of the depth of eight millimetres, and, thus weakened, an attempt was made to break off the growth by using the screw-top as a lever. The top breaking off close up to the bone, a pair of stump-forceps were now used, but only that portion of the tumor containing the broken end of the screw was removed. With the bicuspid forceps the remaining portion of the growth was with difficulty removed.

Very little inflammatory action in the meatus followed the operation. In a few days granulations appeared, which were touched with perchloride of iron at first, and afterward by nitric acid. The hearing was restored at the end of ten days, and in the last inspection, five months after the operation, scarcely a trace of the site originally occupied by the exostosis could be discovered. The time occupied by the operation, including the administration of the anæsthetic, was thirty-eight minutes. The patient during the operation occupied a high-backed armchair.

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NOTES.

THE AUDITORY FORMULÆ OF BRENNER.—In consequence of statements made in a paper recently published by Dr. W. B. Neftel,[1] several letters have lately appeared in the New York *Medical Record.*

In answer to one of these letters, that from Dr. H. Knapp, published in the *Medical Record*, May 22d, Dr. Neftel, in a letter published in the same journal, May 29th, says: "Brenner's classical researches on the effects of the galvanic current upon the auditory nerve were also met with great skepticism, and at first were flatly contradicted by authorities in otology, some even alleging to have repeated his experiments, with perfectly negative results Nevertheless, at present, Brenner's views are accepted by the profession, and I hope the same will ultimately be the case with my researches upon the optic apparatus."

The portion of the above statement with which issue is here taken, is that "at present, Brenner's views are accepted by the profession," which, with the context, implies that the experiments of Brenner have been generally confirmed, and the use of the galvanic current, as based upon his auditory formulæ, generally adopted. A reference to chapter XIX., under the heading "Electricity in the Diagnosis of Disease of the Auditory Nerve," in the thorough text-book of Dr. Roosa,[2] third edition, 1876, shows that the author has carefully reviewed the literature of the subject to that date, and that while Hagen, Erb, and Moos adhered to the theory of Brenner, the two former having written mono-

[1] Ueber die Galvanische Behandlung der Cataracta incipiens. Virchow's Archiv., B. 79, p. 465.

[2] Treatise on Diseases of the Ear. D. B. St. John Roosa.

graphs in its support, Wreden, Schwartze, and other equally eminent observers disputed Brenner's conclusions. Wreden claimed to have established, by careful experiment, the fact that the sounds heard in the ear during the passage of the current, were due solely to the contraction of the muscles of the middle ear, and Dr. Roosa, in summing up, says: "The questions at issue cannot yet be considered settled, though the stronger arguments, at present, appear to favor the theory of muscular contraction."

This difference of opinion among foreign observers would seem, from the paucity of recent papers on the subject, as compared with the numerous publications appearing between the years 1866 and 1873, to equally pertain, at the present time, and so far as this country is concerned, the present writer is of the opinion not only that the views of Brenner have not been generally confirmed or accepted by otologists, but that, in default of being able to substantiate a theory so generally attractive because it seemed to promise a ready means of diagnosis in otherwise obscure cases, the use of the galvanic current as a means of treatment in aural disease has fallen largely into, perhaps unmerited, disrepute.

CLARENCE J. BLAKE.

The Index Medicus: A Monthly Classified Record of the Current Medical Literature of the World. Compiled under the supervision of DR. JOHN S. BILLINGS, SURGEON U. S. ARMY, and DR. ROBERT FLETCHER, M.R.C.S., ENG. New York: F. LEYPOLDT.—This valuable work has now entered on its second year, and has become an indispensable companion to the workers in the profession, be they readers or writers. With such a compendious record of the present medical and collateral scientific literature of the world within the reach of all, literary work cannot but be greatly aided, and the repetitions constantly being made by writers who fail to read up the works of others, may, to some extent at least, be avoided by a more general circulation of the *Index Medicus.*

As a permanent record of medical literature, conveniently arranged for ready reference, its file will be invaluable to every medical library, and to those who, for any reason, do not subscribe to the current medical literature, it will be of great service in indicating where subjects of special interest have been discussed.

The Second International Otological Congress will be held at Milan, Italy, from Sept. 6th to Sept. 9th, 1880. The committee of arrangements consists of Prof. Voltolina, of Breslau, Germany, *President*, and Prof. Moos, of Heidelberg, Germany, *Secretary.*

A New Journal: *The Archives of Laryngology.* The first number of this journal, which is to be issued quarterly, has made its appearance. Its editors are Louis Elsberg, J. Solis Cohen, Frederic J. Knight, and George M. Lefferts, assisted by a number of well-known foreign collaborators.

The editors state in the prospectus that, the advance achieved in this

department during the last twenty years having given it a certain amount of independent recognition, they believe that the time has come for a journal devoted to its special interests.

The contents of the *Archives* are arranged under three departments: I. New Contributions and Literature; II. Report of Contemporary Literature; and III. Miscellany; the latter embracing "Answers to Correspondents," a feature planned to encourage communications between specialists and general practitioners.

The contributions to the first number are on a level with most of the better journalistic literature of the day, and show the advantages of special stimulation in developing the literature of a particular field in medicine.

An interesting feature of the journal consists of the *Clinical Notes*, under which heading several cases not usual in practice are reported. The *Reviews and Book Notices*, and the *Quarterly Report and Abstract of Laryngological Literature*, show careful and painstaking work.

The present number contains one lithographic plate and eight engravings on wood.

The journal is published by *G. P. Putnam's Sons*, New York. Price, per number, \$1; subscription, per year, \$3.

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ORIGINAL COMMUNICATIONS.

ON THE PRESENT CONDITION OF MUSICAL PITCH IN BOSTON AND VICINITY.

By CHAS. R. CROSS and WM. T. MILLER.

(Read before the American Association for the Advancement of Science. Annual Meeting, August, 1880.)

The present paper contains an account of some measurements made at the Massachusetts Institute of Technology during the spring of the present year, in order to determine the amount of variation existing among the standard pitches used by different makers of musical instruments in the neighborhood of Boston.

The measurements were made by the method of beats, comparing the various standard forks with forks of a tonometer whose pitch had previously been determined with accuracy.

Not having a complete standard tonometer at our disposal, the following method was used. A standard C_3 fork, physical pitch, by König, had its number of vibrations per second determined by comparison with a standard fork possessed by the Stevens Institute of Technology, whose rate had been ascertained by Professor Mayer. This comparison I owe to the kindness of Professor B. F. Thomas. From this standard, by the method of beats, we determined the pitch of a C_3 fork by König, giving approximately the French pitch; and thence the pitch of a still sharper C_3

fork by the same maker, giving the Stuttgart pitch. Next above this, among the forks at our disposal, was a copy of Chickering's standard C_3 fork made by Mr. E. S. Ritchie of this city. The pitch of this was determined by comparison with the previously-named fork, and finally from this was obtained the number of vibrations of a high pitch C_3 fork of bell-metal made by Mr. Robert Spice, of Brooklyn. Between the sharpest and the flattest of these forks all the standards of pitch used in this neighborhood are included.

As a check upon measurements made with these forks, a tonometer of short range was constructed by tuning a series of the ordinary small C_4 forks used by musicians, so that each fork should give four beats per second (very approximately) with the one next lowest in pitch. The rate of these forks was also carefully determined by the method of beats, the fork No. 1 of this series being thus made an exact octave of König's German pitch C_3, and its number of vibrations verified by comparing it with the other forks tuned from it, and these with the various C_3 forks already mentioned. In all cases the pitches to be determined were compared with as many different forks as possible. The number of vibrations of the forks used is as follows:

1. Tonometer based on C_3.

König's physical pitch	256.13
" (approximate) French pitch	260.16
" German pitch	264.22
Ritchie's Chickering pitch	269.02
Spice's high pitch of New York	273.85

2. Tonometer based on C_4.

Fork No. 5	520.42
" " 4	524.38
" " 1	528.36
" " 2	532.30
" " 3	536.23
" " 6	540.15
" " 7	544.32

In the case of pitches based upon A instead of C, a tonometer was made from small musician's A_3 forks. The standards tuned

from were forks made by König, viz., the 7th of the harmonic series based on C_2, which gives 896 vibrations per second, and the O fork of his vowel-series, claiming to give 448 vibrations per second. The rate given by König for these forks was assumed to be correct. This leaves room for a slight constant error in the results with the A forks, as the temperature at which the measurements were made was lower than that at which König in his recent paper in *Wiedemann's Annalen* (No. 3, 1880) has stated his older forks to be in exact accordance with the rate stamped upon them. The error would not amount to more than a tenth of a vibration, or thereabouts. The rate of the vowel-forks, which is not marked upon them, is that given to me verbally by the maker. Assuming the forks mentioned to be correct, the rates of the forks of the A tonometer were as follows:

No. 3	448.0
" 2	444.1
" 1	440.1
" 4	436.2

The C forks are not liable to the constant error mentioned, as the various forks were compared with each other at a temperature agreeing closely with that at which the rate of the standard C_3 was determined.

The intervals of time during which the beats were counted were estimated by means of a stop-watch, made by the Auburndale Watch Company, and known to the trade as the "Auburndale Timer." This reads to one-eighth seconds, and was found, notwithstanding its low cost, to be a very serviceable instrument for purposes of this nature. The rate of the watch was frequently determined, and a correction applied to the measurements of time.

The number of beats which could be counted was of course very different in different cases, varying with the quality and mass of the fork. Whenever the number of beats was small, on account of rapid diminution of intensity of the sound, great care was taken to make a number of sets of observations, and in almost all cases the results obtained rest upon a number of comparisons with different forks.

Notwithstanding its cheapness, the small C_4 tonometer was found to be very useful, and susceptible of sufficient accuracy for all practical purposes of determination of standards of pitch. In constructing such a tonometer the forks should be carefully selected, tested for duration of tone, and in tuning care should be taken to file away both prongs by as nearly the same amount as possible. To secure the forks from the change of pitch which might arise from heating by contact with the hand (which heating is of course far more rapid with these small forks than with the large ones generally used as standards), the handles should be mounted in cork. Care must be taken in doing this not to damp their vibration. If two small forks of the same mass and dimensions be compared when held in the naked fingers, and then when held in the cork handles, little or no difference of relative pitch will be noticed; but if one be held in the naked fingers, and the other protected, the effect of heating becomes evident. Hence this precaution of shielding the handle of the fork from the direct effect of the warm hand, is especially necessary when a large fork, which is but slightly and slowly affected thus, is compared with a small one, in which the effect is rapid and great. In our experiments this influence was carefully guarded against. Also with the small forks, which were sounded by percussion, the first few beats were not counted, to avoid any possible influence of excessive amplitude of vibration. In some cases we thought that we had observed an effect due to this, but could not assure ourselves that this was frequently the case.

The following table gives the results of our measurements. It will be seen to embrace a few pitches from other cities. The temperatures at which the comparisons were made were from 68° to 72° F. In the case of comparisons with pipes, the temperature is given in the table. The results after No. 9 are given in the order of their sharpness. Those measurements marked with an asterisk were made by Mr. Miller alone, the others by both the authors of this paper. The number of vibrations is given for C_3, but where C_4 forks or pipes have been measured in ascertaining the standard pitch, it is stated in column four.

TABLE.

No.	Designation.	No. of Vibrations.	Remarks.
		C_3	
1	König, physical pitch	256.1	Stamped 512 *v.s.*
2	König, French pitch (approximate)	260.2	Stamped 520 *v.s.*
3	König, German pitch	264.2	Stamped 528 *v.s.*
4	Ritchie, physical pitch	256.2	
5	König, physical pitch	256.2	Stamped 512 *v.s.*
6	Marloye, physical pitch	256.4	Made between 1845–50.
7	Ritchie	259.1*	Made about 1868.
8	Ritchie	259.4*	" "
9	Ritchie, copy of Chickering's standard	269.0	Made about 1868.
10	Mason & Hamlin, French pitch	259.1	Used for a few years only.
11	Hutchings, Plaisted & Co.	264.0	Low organ pitch, C_4 fork measured.
12	Hook & Hastings, old flat organ pitch	264 6	C_4 pipe measured. Temperature, 69° F.
13	Organ in church of the Immaculate Conception, Boston	266.7	C_4 pipe measured. Temperature, 69° F.
14	Smith American Organ Co.	267.2*	C_4 fork measured.
15	New England Organ Co	268.2	C_4 fork measured.
16	Chickering's standard fork	268.5*	C_3 fork, marked "1865, standard pitch."
17	H. F. Miller, pianos	268.9*	C_4 fork measured.
18	Mason & Hamlin, present standard pitch	269 0	C_3 fork, measured.
19	Fork of W. H. Clement, tuner	269.2	C_4 fork, measured.
20	George Woods & Co., cabinet organs	269.5	C_4 fork, measured.
21	Hook & Hastings, present standard pitch	270.0	C_3 and C_4 pipes measured. Temperature, 73°
22	Chickering piano used at Joseffy concerts, 1880	270.1	C_4 fork of tuner measured.
23	Covent Garden pitch, 1879	270.3	C_4 fork furnished by R. Spice.
24	Weber pianos	270.3	String of piano measured.
25	Thomas' pitch	271.1	C_4 fork furnished to builders of great Cincinnati organ.
26	Music Hall organ	271.2	C_3, principal, great. Temperature 70° F.
27	Steinway's pitch	272.2	C_4 fork furnished by R. Spice.
28	Highest New York pitch	273.9	C_3 fork furnished by R. Spice.
		A_3	
29	Nichols' fork, Boston, Germania orchestra	448	Corresponding to untempered C_3, 269.
30	Marloye's A fork	426	Imported by Prof. Lovering, 1845–'50.
31	Florence pitch, Marloye	438	" " "
32	Vienna pitch, Marloye	446	" " "
33	Milan pitch, Marloye	448	" " "

In some cases considerable difficulty was experienced on account of the brief duration of the sound of the small forks used as standards by some makers. Nevertheless, the various repetitions and comparisons were carefully made, and the extreme difference of our results in different observations with forks is rarely over one-tenth of a vibration. When pipes were used larger differences were occasionally noticed.

A reference to the table shows that the lowest pitch at present used by any of the makers whose standards have been examined, is that of Messrs. Hutchings, Plaisted & Co., Church Organ builders, of this city (No. 11). Their pitch is identical with the German pitch, and has been adopted by them because, in their judgment, it is better adapted for choral purposes than is the extremely high pitch in common use in this country. It is substantially identified with No. 12, the old, flat pitch formerly used by Messrs. Hook and Hastings. The fork of the Smith American Organ Co., builders of Cabinet Organs (No. 14), lies between the German pitch and that of the Chickerings, and from this latter pitch (No. 16) the rise is gradual to the highest reached, No. 28. This is the pitch of a large C_3 bell-metal fork made a few years since by Robert Spice, of Brooklyn, and claiming to give the "9 P.M. concert pitch" of New York city. It is taken from a reed instrument used by Mr. Spice as a standard, who remarks that he was obliged to raise the pitch after bringing it to this country from London, by about an eighth of a tone.

The pitch of the Steinway pianos, No. 27, was taken from a fork tuned for us by Mr. Spice. Its rate is a little lower than the number given by Mr. Ellis in his recent paper read before the Society of Arts, London. The fork, No. 23, giving the Covent Garden pitch, was also furnished by Mr. Spice, being tuned by him from a recently imported English concertina. The Steinway pitch is also stated by Mr. Spice to be identical with that of the New York Philharmonic Society, which is given by the oboe, a standard to which many musicians seem firmly attached, notwithstanding the manifest objections to using it instead of a fork. No. 24, Weber's piano pitch, was taken from a freshly-tuned piano in

the wareroom of their agent in Boston, and hence may not represent the exact pitch used by the maker.

The fork A_3, No. 29, is the standard furnished by Mr. Nichols as that used by the Germania Orchestra of Boston. It is stated to be identical with that of the Boston Philharmonic Orchestra and the Harvard Musical Association. This gives 268.8 vibrations for an untempered C_3 on the same scale.

The remaining A_3 forks, a standard of Marloye's, and three forks made by him and giving the pitch in use at Florence, Vienna, and Milan, were imported by Professor Lovering between the years 1845 and 1850. The results of the measurement of these forks give for the pitch of Florence 438 vibrations; for that of Vienna, 446 vibrations; and for that of Milan, 448 vibrations.

In addition to these determinations of standard pitch, we have endeavored to obtain some information as to the manner in which the standards themselves were originally determined.

The standard fork at the Chickering's manufactory is a large C_3 fork, marked "1865, Standard Pitch," making 268.5 vibrations per second. The fork has its prongs inclined toward each other, which, as Scheibler has remarked, is objectionable in a standard fork, on account of variation of rate with amplitude. This is, however, not of much consequence if the fork is merely used for tuning instruments for sale. No facts could be ascertained regarding the maker of the fork, or the manner in which its pitch was determined, but the Messrs. Chickering state that it has the same pitch as the forks used by them before its construction. They also inform us that the standard of all their forks, is the standard pitch of the Philharmonic Society of New York, taken from the oboe, and in "perfect tune" with it. It will be noticed, however, by an inspection of the table, that the pitch of the Chickering 1865 standard is 268.5 vibrations, while that of the Steinways, also claimed as identical with the New York Philharmonic pitch, is, according to Mr. Spice's fork, 272.2 vibrations. Also the fork used in tuning for the Joseffy concerts (No. 22) gave for C_3 270.1 vibrations. These differences are quite noticeable, though less than those arising in the pitch of the oboe, which is so often taken as a standard by musicians. Mr. Miller also made an ap-

proximate measurement of an old C_4 fork used by the late Mr. Jonas Chickering, who gave it to the father of the gentleman now holding it, and who has had it in his possession for over twenty years. It was then supposed to represent the English concert pitch, but, as measured, gave only 522 vibrations per second, which corresponds to the French pitch.

As already remarked, the Chickering pianos, when used in the concert-room, are sometimes at least a little higher than their standard pitch. No. 22 is 1.1 vibrations sharper than No. 16, the standard, 1.6 vibrations flatter than the pitch of the Music Hall Organ at 70° F, and 2.1 vibrations flatter than the pitch of the Steinways. It is also very possible that the pitch of pianos in the concert-room may frequently be raised by the tuner a little above that of the fork carried by him, as it seems to be a frequent practice of tuners to tune a little sharp or a little flat, according to circumstances.

We have not been able to ascertain any facts regarding the origin of the pitch of the Messrs. Steinway beyond those already stated. Mr. Ellis, in the paper already referred to, gives a somewhat higher value ($A_3=457$ vibrations) than that found by ourselves.

The fork used at the manufactory of Mr. Henry F. Miller, of this city, for new pianos, is a small C_4 fork, giving 537.8 vibrations per second. A second C_4 fork, used by the same tuner for new pianos in houses, is about five vibrations per second flatter, and a third, which he uses for old pianos is a very close approximation to the French pitch. No. 19 is stated by Mr. Clement, the owner of the fork, to be of the exact pitch used by Messrs. Hallet & Davis for their pianos, and by Mr. Geo. H. Ryder for Church organs.

The standard used by Messrs. Mason & Hamlin for their cabinet organs is a large C_3 fork, giving 269 vibrations per second, and of the same shape and size as the Chickering 1865 standard. It has been used by the firm since 1866. At one time, when the Music Hall Organ was tuned to the French pitch, these makers tuned their cabinet organs to this low pitch, but instead of having a new fork manufactured, two thin weights of steel were made, which could be attached by wax to the ends of the prongs, so as to

lower the pitch by the desired amount. The quantity of wax used in fastening these weights would of course perceptibly affect the rate of the fork. As given to us by the owners, the fork was a little flatter than the standard French pitch, giving 259.1 vibrations instead of 261 vibrations per second. It was stated to us that in New York complaint has been made of the present pitch of cabinet organs as too low, the higher Philharmonic pitch being taken as a standard. It is also said by various organ-builders that they have no desire to raise the present pitch, but that some manufacturers of pianos intentionally sharpen the pitch and desire all organ-builders to do the same.

Fork No. 20, the standard of Messrs. Geo. Woods & Co., makers of cabinet organs, is a small C_4 fork, copied in pitch from the fork of Mason & Hamlin, but an octave higher, and is slightly sharper than it. We are told by this firm, that they have frequently received complaints from cities abroad regarding the high pitch of their organs, the places particularly mentioned being Stockholm and Copenhagen. This might of course be expected in all places in which the French pitch is used as a standard.

The fork of the Smith American Organ Co. is a small C_4 fork, giving 534.4 vibrations per second. It is of quite low pitch and was originally obtained in 1866. Mr. Smith at that time tuned a fork to unison with one used by Signor Arditi, director of the orchestra of the opera company then performing in Boston, and has since used this pitch as a standard. The fork has been carefully preserved, twelve others having been copied from it for ordinary use. These facts given by Mr. Smith are also interesting as showing that in this city there has certainly been a decided variation in the pitch of the opera.

The standard of the New England Organ Co. is also a small C_4 fork.

The standard used by Messrs. Hook & Hastings is a C_4 metal pipe, which at a temperature of 73° gives 540 vibrations per second. This is probably about the pitch of their organs as used in churches, but in the concert-hall the pitch must rise very considerably above this. The same remark of course applies to all measurements of pipe organs, and in a less degree to reed organs. Though we have

had no opportunity of actually ascertaining the fact by direct measurement, it is evident that the pitch of the Music Hall Organ must rise much above even the highest pitch given in our table. The standard pitch formerly used by Messrs. Hook & Hastings, in common with several other church organ-builders, was substantially identical with the German pitch. A C_4 metal pipe formerly used as a standard, and preserved by this firm, gave, at a temperature of 69°, 529.2 vibrations per second. Several of the organs of Messrs. Hook & Hastings, in this city, still remain tuned to this flat pitch. Among these Messrs. H. & H. mention the organs in St. Paul's Church, built in 1854, Church of the Unity (1859), Berkeley St. Congregational (1861), West Church (1861), Arlington St. Church (1861), Eighth Methodist (1861), Emmanuel (1862). In 1863, on building the organ for the Church of the Immaculate Conception, they raised the pitch to 533.4 vibrations per C_4, at 69° F., and at some time since a still further rise to their present pitch (540 vibrations for C_4, at 73°) has taken place. Among the larger organs by these makers, in this vicinity and elsewhere, tuned to this pitch, are those in Mechanics' Hall, Worcester (1864), South Congregational Church, Boston (1864), Plymouth Church, Brooklyn (1865), Cathedral, Boston (1875), and Tremont Temple, Boston (1880). The large organ built by Hook & Hastings for the Music Hall in Cincinnati, was tuned to a fork sent by Mr. Thomas for that purpose. This fork gives 542 vibrations per second, according to our measurements, which may also be taken as giving the pitch used by Thomas' Orchestra. The measurements of this fork (No. 25) were, however, less satisfactory than most of our measurements, as they were performed under somewhat distracting circumstances, and there is a liability to an error of as much as half a vibration in our result. The standard pitch of the Roosevelt Organ Co. is stated to be substantially the same as that of Messrs. Hook & Hastings.

Messrs. Hutchings, Plaisted & Co. use as a standard a small C_4 fork giving, as already remarked, the German pitch. Among the organs by these builders in this neighborhood and at this pitch, are those in St. John's Church, Roxbury; Old South Church, Boston; All Saints Church, Worcester, and Mr. Eugene Thayer's Studio Organ, Boston.

A few facts were also obtained with regard to the standard used by some of the makers of orchestral wind instruments.

The Quimby Bros., makers of brass wind instruments, tune by a cornet. The instruments are tuned a little sharp to allow for flattening in the band. Our observations were less accurate than we could desire, as we were obliged to make use of an ordinary watch instead of the stop-watch. The pitch was found, however, to be higher than that of Steinway's pianos. The liability to error in using such a standard is evident from the great degree in which the pitch of a cornet may be varied in blowing. A reed instrument used by another manufacturer can be varied as much as a quarter of a tone by variation in wind pressure. A reed (C_4) used by Mr. J. H. White gave (approximately) 538 vibrations per second, which is identical with Chickering's standard. This gentleman also informs us that he is obliged to raise the pitch of Boehm flutes, as made in New York, to be in unison with the concert pitch here, which he generally does by shortening the piece containing the mouth-hole.

A reference to the table will show that we have now in use in this city at least two distinct pitches, the low German pitch, found in those older organs which have not had their original pitch altered in retuning, and also now used entirely by Messrs. Hutchings, Plaisted & Co., and the high pitches used by the Messrs. Chickering, Hook & Hastings, and most others. There is, however, a very noticeable difference between the different high pitches, though there is such a gradual rise from the lowest to the highest that no separate grouping can be made. The difference between the pitch of the Music Hall Organ towards the middle of an evening concert, and that of a piano tuned to Chickering's pitch, would be greater than the difference between this last and the lowest pitch used in the city.

The organ in the Music Hall will naturally be considered as giving the standard pitch of the city of Boston. It is somewhat higher, however, than the orchestral pitch as given by the fork of Mr. Nichols (No. 29), and the difference would rapidly increase with a rise of temperature. This pitch has been used since 1871, at which date, on retuning the organ, the pitch was raised to its

present value. During the years between the opening of the organ (1863) and 1871, it was at the French pitch, and this was consequently the standard for the oratorios and those concerts at which the organ was used. An attempt was also made to use the same low pitch in the symphony concerts, and for a while it was employed. The history of the pitch of the great organ is, however, so well known, that it need only be referred to here. The great cost of re-tuning the organ, even were there no other difficulty, renders it unlikely that any attempt to lower the present excessively high pitch will be made in this city for some time to come. It seems, however, much to be desired that we should follow the example of the majority of European nations in this respect. Especially is this important in the light of Mr. Ellis' recent proof (*Nature*, April 8, 1880), that not merely the works of Händel and Haydn, but those of all the founders of modern classical music, were written to a pitch (A_3, 423 vibrations, or thereabouts) considerably lower than the lowest orchestral pitch at present used in any country, lower even than the physical pitch. The present high pitch used in Boston, like that of New York and London, is over a diatonic semitone sharper than this classical pitch.

It is stated by Mr. P. J. Boris, of this city, that just after the Peace Jubilee of 1872, twenty different musicians united and gave to him as a standard of pitch a reed tuned by Mr. Smith, of the Smith American Organ Co. This was sent to France, and from it the instruments imported by Mr. Boris have been tuned. These are now complained of as being too flat, by four or five vibrations per second, an interesting fact, though much less conclusive in proving a rise in pitch than if a fork had been used as a standard.

With regard to standards used for scientific purposes, almost all such forks in the vicinity were made by König. The only others that have come to our notice, are one made by Marloye (No. 6) in the possession of Professor Lovering, of Harvard University, and those made by Messrs. E. S. Ritchie & Sons. The Messrs. Ritchie have made tuning-forks for scientific purposes for many years, and several of their forks have been measured by us. The standard at present used by them (No. 4) is identical with König's in pitch, but the owners do not recollect where it was originally obtained. It is

not, however, one of König's forks. The first pitch used by them was between the physical and French pitches. Nos. 7 and 8 are two forks made by them about 1868. Afterwards their fork was compared with one by König, but they do not recollect that it was altered to correspond to this. Nevertheless, as the present standard is of the same form as the old forks, with the prongs bent toward each other at their extremities, there seems little doubt that the same fork was at some time lowered in pitch to correspond with König's standard. The fork was originally imported from Duboscq, and was very possibly originally made by Marloye, as it is similar in form to his pattern.

Another point made evident in our observations is, perhaps, worthy of notice. It is a familiar fact that a new fork, tuned accurately to unison with another, is, after a short interval, almost invariably found to be sharper than the fork from which it is copied. This is, of course, due to the heating of the fork in the process of filing, which tends to flatten it, and the subsequent rise in pitch upon cooling. That this has had any considerable influence upon the rise in pitch during the past century is doubtful, but that such a rise actually occurs among forks used by musicians, is shown by a comparison of the rates of certain forks measured by us.

The standard fork made for the Chickerings in 1865, has for its rate 268.5 vibrations per second. A copy of it, made for Mr. E. S. Ritchie in 1870, has the rate 269.0 vibrations, a rise of half of a complete vibration. Again, the standard Mason & Hamlin fork (No. 18) gives 269 vibrations, while the fork of the George Woods Organ Co. (No. 20), copied from Mason & Hamlin's standard, gives 539.1 vibrations, which for C_3 would be 269.5 vibrations; also a rise of half a vibration. If, as seems probable from their identity in shape and size, the standard of Mason & Hamlin is copied from that of the Chickerings, there is here still another instance of the same effect. The influence of such an effect as this would soon be noticed if several forks were tuned successively, each from the one below it in pitch.

It is a curious fact that with many musicians there is an idea that a fork is liable to change its pitch to a noticeable extent in course of time, while, as a matter of fact, it is well known to every

student of acoustics that a fork properly used and kept is, after having recovered from the disturbances introduced in tuning it, practicably invariable in its rate under similar conditions. It seems to us that there are two ways in which the above-mentioned error may have originated. First, from the mistaken idea that since the oboe is so much less variable in its pitch than most orchestral instruments, under differences of blowing, etc., that it is really constant under all circumstances, something that can never be true of any vibrating column of air. If, then, forks are tuned by the oboe, considered as a standard, and subsequently compared with the same instrument, the pitch of the fork must appear to vary from time to time in a seemingly inexplicable manner. Secondly, it is very probable that forks have frequently been tuned to a definite pitch, and no attention paid to the sharpening which occurs on cooling, in which case the fork would seem to have varied in its rate, to one who was unfamiliar with the physical changes involved.

While engaged in these investigations an anomaly in our methods of tuning has frequently attracted our attention. In this country, as in England, it is customary to use C as a starting point in tuning pianos and organs, while A is universally taken as a starting point in the tuning of orchestral instruments. It is evident that when instruments tuned to the equally-tempered scale, with C as a basis, are played with others tuned to the tempered scale, with A as a basis, they can never be in tune with each other, as the effect of tempering will be different according to the temperament proceeds from C or from A. This is, of course, supposing that the A in question is a true major sixth of the C. If the A is a tempered sixth this statement will, evidently, not apply, so that if an orchestra tunes to the A of an equally-tempered organ instead of to an A fork or the A of the oboe, no difference of tune will arise from the cause stated, and hence our system, or rather want of system, is less objectionable than it would otherwise be. If the point is neglected, however, it adds a new source of confusion to the difficulties arising from our system of temperament and from the variation of pitch of wind instruments with the temperature and with the mode of sounding them; and additional duties are im-

posed upon the performers by requiring them to correct the variation by varying the tune of their individual instruments. It would certainly be more philosophical to tune all musical instruments from the same note as a base, either C or A, and it is very possible that it would be found to be of practical value. In Germany and France this is always done, but in this country the matter seems to be entirely overlooked.

As an instance of the trivial circumstances which frequently determine some of these matters, one of our best tuners of church organs told us that he formerly tuned from an A fork brought by him from Germany, but that he lost his fork, and bought a new one, which happened to be a C fork, and since then, without any greater reason, he had used C as a basis in all his work.

In conclusion, we would express our thanks to those manufacturers and others who have aided us by allowing us to measure their standards of pitch, as well as by favoring us with the information regarding the origin of these standards which we have stated in the preceding pages.

FRACTURES OF THE TEMPORAL BONE.

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NEW YORK CITY.

(Paper read before the New York County Medical Society, September 27, 1880.)

Mr. President and Gentlemen—The subject which I have chosen for my paper this evening is generally considered to belong to the domain of general surgery, and it may therefore seem somewhat strange to many of you that I, who am not a general surgeon, should have ventured to discuss such a theme. A fracture of the temporal bone, however, implies, almost necessarily, damage to some part of the middle ear or labyrinth, and, in consequence of this, many of these cases of fracture, after leaving the surgical wards of our hospitals, come into the aurist's hands for the relief of a partial or total loss of the sense of hearing. My experience with cases of this class is therefore necessarily one-sided. It does not extend to the fatal cases, nor does it cover the first stage of the illness, except in so far as the facts relating thereto can be learned from the patient or from his friends. The picture which I may be able to draw of this traumatic affection must therefore depend for its value chiefly upon the degree to which it supplements those already drawn by surgical authors.

By reason of certain peculiarities in the construction of the temporal bone, fractures that take place in it are apt to occur at certain spots, or along certain fixed lines, where the bone is weaker than at other points. These lines correspond with the lines of union of the three bony portions which together form the temporal bone, and which originally (in the fœtus) were separate centres of development, viz., the squamous portion (together with the zygoma), the tympanic portion (annulus tympanicus), and the petrous portion (together with the mastoid process). Fractures at these points

are perhaps, strictly speaking, simply diastases. There is a fourth region, however, where the bone is particularly weak, and where a genuine fracture is very apt to occur. I refer to the central portion of the pars petrosa, where the bone is hollowed out by a series of cavities (the meatus auditorius internus, the cochlea, the vestibule, and the semicircular canals), separated from each other by comparatively thin partitions of bone. Finally, the squamous and the mastoid portions of the temporal bone, situated as they are upon the outer surface of the skull, are liable to be fractured or cracked at any point, viz., wherever the direct force of the blow or fall may be applied. Of the other fractures—viz., those occurring in the deeper parts of the temporal bone—a large proportion are undoubtedly produced by *contrecoup;* that is, in falling the patient strikes upon the back or top of his head, while the fracture occurs at the base of the skull. In the technical sense, however, I believe that the term "fracture by contrecoup" is applied only to those cases in which the direct force of the blow or fall is received upon the side opposite to that on which the fracture occurs. Aside from the treatment, the most practical question connected with fractures in this region is, how far can they be diagnosed at the bedside?

From a study of the fourteen cases which have come under my observation, I find that I can make two grand subdivisions of fractures of the temporal bone, viz.:

1. Fracture or diastasis of the tympanic or squamous portion in the region of the middle ear, without implication of the petrous portion.

2. Fracture of both the tympanic and the petrous portions.

In one or two of these fourteen cases the symptoms observed seemed to justify the establishment of a third subdivision, viz.: fracture of the petrous portion of the temporal bone without implication of the middle ear. The chain of evidence, however, though pointing strongly to such a conclusion, is not sufficiently complete to warrant the introduction of this third class.

Class I., which includes cases of fracture of the temporal bone in the region of the middle ear, without implication of the petrous portion, may be broken up into smaller subdivisions. Thus, for example, we may have:

1. *Cases in which no visible hemorrhage or other discharge takes place from the ear.*

2. *Cases in which a hemorrhage or bloody discharge from the ear follows the accident.*

3. *Cases in which the accident is followed by spitting of blood, due to its escape from the middle ear, by way of the Eustachian tube, into the naso-pharyngeal cavity or nasal passages.*

Of the first subdivision I can give no examples. Of the second I can give two, as follows:

Case I.—The patient, a carpenter, thirty-four years of age, was struck on the head by a falling plank, on the 1st of July, 1878. The blow rendered him unconscious only for a few minutes. He was then shortly afterward able to resume his work, though not feeling right in his head. On the 8th of July he came to the Infirmary to obtain relief. He said that there had been a constant blood-stained, watery discharge from the left ear, and that the pain in his head had been steady and quite severe. He had noticed some impairment of the hearing on the left side, and a sensation of numbness on the forehead and on both sides of the face. He had also observed that when he exposed himself to the sun, and when he lifted heavy objects, the headache was much aggravated. His gait was perfectly steady. On examination, I found that there was still an oozing of bloody serum from the left ear, and that the hearing was so far impaired that the patient could hear the ticking of the watch only when it was pressed against the ear. The soft parts lying immediately above the drum-membrane were red and so much swollen that only the lower part of the membrane itself was visible. No perforation could be seen.

(My notes contain no memoranda of the treatment adopted.)

On the 31st of July the patient was seen a second time. He still complained a little of his head, but the discharge from the ear had ceased, and the hearing had been restored to almost its normal degree of acuteness.

During the following October the patient was seen a third time, and was found to be perfectly well in every respect.

Case II.—Machinist (Bridgeport, Conn.), fifty-two years of age and well nourished. Nov. 28, 1873. Sixteen days ago he received a blow on the right side of the head. It was followed immediately by profuse bleeding from the right ear, and partial unconsciousness. The bleeding continued for eight days, during a part of which time he had daily chills, with fever, followed by sweating during the night. Tinnitus, total deafness, pain and dizziness were the other prominent symptoms. He does not remember having noticed any discharge from the ear after the bleeding ceased. On the second day the

pain in the ear became quite severe, and continued with increasing severity up to the eighth day. Coughing and blowing the nose aggravated the pain. At first it was confined to the ear alone, but it soon extended to the parts behind and above the ear, and eventually to the entire right side of the head. A cough, which has now become very troublesome, developed on the fifth day. It is associated with a profuse muco-purulent expectoration. The patient has had no distinct chills since three days ago. Chilly sensations and sweating, however, still continue. He complains of feebleness. He was positive that the hearing in both ears was perfect before he received the blow on the side of the head. During the past few days he has experienced an almost constant desire to sleep. (This symptom is very marked. The moment the man has finished answering my questions, and while I am writing my notes, he drops off into an apparently sound sleep, from which I am obliged to rouse him before putting a new question to him.) Face and neck noticeably congested. Veins on the forehead and temples stand out prominently. Pulse, at wrist, 72, and feeble. Respirations (counted while he was asleep in the chair) 28 to the minute. Watch heard when firmly pressed against the ear. Vibrations of the tuning-fork are uniformly referred to the right ear. With the good ear closed, the patient can distinguish correctly only now and then a word spoken loudly in close proximity to the right ear. No appreciable redness or swelling of the mastoid integuments. This region. however, and also the temporal region are both quite tender on pressure. Eustachian tube easily inflated. External auditory canal normal. Membrana tympani congested and œdematous; no bulging.

Under date of July 1, 1874, Dr. George F. Lewis, his physician, wrote that the patient gradually recovered his health, and was at that time perfectly well.

Finally, in the third subdivision of Class I. I would place the following case:

Case III.—The patient, a female, twenty-five years of age and in good health, was seen by me at the N. Y. Eye and Ear Infirmary, on the 15th of June, 1870. She gave the following history: Four days previously she fell, striking upon the left side of the head. Since then she had experienced moderately acute pain in the right ear, and constant noises, like the rushing of waters, but no appreciable deafness. On the day following the accident she occasionally spat a little blood. On examination I found the right drum-membrane partially concealed by a bloody blebs, which projected forward from the posterior and upper portion of the canal, at its line of junction with the membrana tympani. The drum-membrane itself—so much of it, at least, as was not concealed by the bloody tumor—presented a purplish red appearance. There was tenderness on pressure both behind and in front of the ear.

The watch was heard at a distance of six inches. Treatment: puncture of blebs; warm douche every half hour until pain had been relieved.

On the 18th of June she reported that a slight discharge from the right ear had made its appearance on the 16th. Pain steadily diminishing. Watch heard at a distance of only three inches. No perforation in the drum-membrane visible.

On the 9th of July she reported that the discharge had ceased. On examination I found that the membrana tympani had lost its red color, and presented simply an opaque appearance. External auditory canal normal. No pain. Patient simply complained of an unpleasant resonance of her own voice in the affected ear. Watch heard at a distance of twenty inches.—Aug. 3d. Watch heard at a distance of six feet before inflation, and nine feet after it.

In reference to these three cases, let me call attention to the fact that in all of them there were unmistakable evidences that some serious injury had been done to the parts immediately surrounding the drum-membrane, and yet in all of them the hearing was not seriously affected. For the present I will simply mention these two circumstances as constituting the prominent characteristics of cases belonging to Class I., or cases of fracture of some portion of the temporal bone in the immediate neighborhood of the drum-membrane.

Class II. comprises cases of fracture involving both the tympanic and the petrous portions of the temporal bone. These cases are, as a rule, of a more serious character than those belonging to Class I. The severity and duration of the illness which immediately follows the accident are usually so great that the aurist never sees such cases until after the characteristic lesions in the region of the drum-membrane have disappeared. The line or lines of fracture may run in a variety of directions, and may involve other organs beside that of the ear proper. From the symptoms produced by the accident, we may also, in many cases, locate more or less accurately the course pursued by the fracture. In illustration of this second class I will give here briefly the histories of ten cases:

Case IV.—Robert K., a liquor dealer, twenty-nine years of age, consulted me at the N. Y. Eye and Ear Infirmary on the 23d of October, 1872. He gave the following history: Four weeks previously he fell from a wagon and struck upon his head. Blood flowed out of his right ear, as he was told, and he re-

mained in an unconscious state for about twenty hours. When consciousness returned, he noticed that he was entirely deaf in the right ear. The objects in the room seemed to him to be going round in a circle. He vomited twice. For a period of nearly two weeks he was unable to go about without assistance, on account of the difficulty which he experienced in maintaining his balance. Then, as improvement took place in this respect, he was able to walk about with the aid only of a cane. During the few days immediately preceding his visit to the Infirmary, he had been able to dispense with all assistance. At first the subjective sounds were of a musical character, but they gradually gave place to a simple ringing or roaring. On examination I found no lesions of any importance in the right ear; the parts were practically in a normal condition. When the watch was pressed against the centre of his forehead he heard its ticking faintly in the left ear. (Treatment with iodide of potassium was advised, but the patient was not seen again.)

Case V.—Louis Anderson, a seaman, twenty-five years of age, was struck on the head by a falling heavy cable, on or about March 15, 1874. He did not lose consciousness. As soon as he had recovered from the acute pain of the blow, he noticed that blood was running out of the right auditory canal, and that he could hear only with the left ear. He also discovered that he was unable to close the right eye; and later, when he attempted to eat, he found that pieces of food lodged in the right side of the mouth, and that, in drinking water, some of it escaped from this same side. He was questioned with regard to his powers of tasting, but, so far as could be learned by mere questioning, his sense of taste had not been affected.[1] Gradually all the symptoms disappeared, with the exception of the deafness and a slight trace of the facial paralysis. Finding that the deafness persisted, the patient came to the Infirmary on the 29th of April, 1874.

As the drum-membrane presented a perfectly normal appearance, and the facial paralysis was discoverable only upon careful search, I discouraged him from expecting any beneficial results from treatment.

Case VI.—David Brant, a boatman, twenty-two years of age, fell, during the last week of January, 1874, a distance of about fifteen feet, striking upon his head. He remained in an unconscious state for about half an hour. During the following week there was a constant watery discharge from the right ear. Then the patient became very ill, the prominent symptoms being pain in the head, fever, and delirium, with a continuation of the thin, watery discharge from the right ear. This acute illness lasted nearly two weeks, and from that time to the date of his visiting the Infirmary (March 28, 1874) he

[1] Such a case has been reported by Brunner: Archiv für Ohrenheilkunde, Bd. V., p. 32.

slowly but steadily regained his general health and strength. The discharge, which became decidedly purulent in character during convalescence, was still quite active at the time when he visited the Infirmary. On examination I found the right auditory canal filled with pus. The drum-membrane was perforated posteriorly, and its lower half, especially anteriorly, was converted into an irregular mass of granulation tissue. So far as I could ascertain, the hearing power had been totally destroyed in this right ear. When the watch was placed between his teeth in the median line, the patient said that he heard its ticking in his left ear.

Treatment was commenced for the purpose of arresting the discharge, but the patient never returned. He was told that he would probably never recover the power of hearing in his right ear, and this undoubtedly drove him away from the institution.

Case VII.—About the 1st of September, 1877, Michael Kennedy, a laborer, forty years of age, fell from a scaffolding thirty feet high, and struck upon his head. He was found in an unconscious state, and remained so for two hours. For a period of two weeks and a half after the accident he was unable to leave his bed. During this time he was obliged to maintain a half-sitting posture, as whenever he attempted to lie down at full length the pain and distress in his head became unbearable. I was unable to learn exactly what his symptoms were during this period, or whether he had been delirious or not. He was quite sure, however, that no blood nor any watery discharge had come from either ear. He remembered having been very much annoyed by a constant tinnitus, particularly in the left ear. Going upstairs or shaking his head, he said, aggravated the tinnitus very much. When he had so far recovered that he was able to leave his bed, he experienced great difficulty in maintaining his equilibrium. His head, he said, seemed to him as if it weighed a ton, and he felt all the time as if he were on the point of falling. This difficulty in walking did not materially improve until about the middle of the following December. From that time to the 27th of December, when he made his first visit to the Infirmary, quite rapid improvement had taken place in this respect. At the time I saw him he was able to walk fairly well; there was no paralysis, but simply a lack of co-ordinating power. There was total loss of the hearing power in the left ear. Drum-membrane normal in texture and position. Hearing power of the right ear nearly normal. (No treatment advised.)

Case VIII.—The patient, a boy seven years of age, was brought by his mother to the Infirmary on the 8th of January, 1873. She stated that about six months previously he had passed through, first, scarlet fever, and then cerebro-spinal meningitis, which left him with a staggering gait. While in this condition he fell backward out of a wagon, and struck upon the back of

his head. Inflammation of the brain set in, and, as a result of this, the boy became totally deaf. The mother, who was an intelligent woman, was positive that the deafness only developed after this accident, and not after either of the other illnesses. She was also confident that there had never been a discharge from either ear. On inspection I found both drum-membranes practically normal.

Case IX.—John O'Brien, a boy twelve years of age, was knocked off the steps of an omnibus and fell, striking his head heavily against the pavement. He was taken up in an unconscious state, and was afterward "very ill" for several weeks. When he recovered, it was discovered that he had entirely lost the power of hearing in both ears. The parents state that there had never been any hemorrhage or discharge from the ears, and that the boy had not even complained of pain in the ears. On examination, December 6, 1873, a year after the occurrence of the accident, I found both drum-membranes perfectly healthy.

Case X.—John Miller, a framer, fifty-eight years of age, came to the New York Eye and Ear Infirmary on the 29th of April, 1874. He said that in the spring of 1873 he fell a distance of eleven feet, striking upon his head. Blood flowed from both nostrils and ears. He was then "very ill for a long time," and in answer to my questions said that he had been out of his head part of the time. During recovery he found that he was almost totally deaf; at the same time he suffered from ringing noises in the head and from dizziness, and experienced considerable difficulty in swallowing. The deafness is still very marked (almost total), and he is not yet free from the other symptoms mentioned. Both drum-membranes are intact, though opaque and thickened. (No treatment advised.)

Case XI.—Elenora Smith, a healthy girl, six years of age, was brought by her mother to the Infirmary on the 24th of July, 1872. The following history was given: Three months previously the child fell downstairs, and was ill for about a month with fever, delirium, and spasms. During recovery the mother discovered that the child was perfectly deaf. She thinks that she made this discovery about ten days or two weeks after the occurrence of the accident, and at about the same time she noticed that there was a discharge from the left ear. The child's hearing previous to the accident had been perfect. When she was brought to the Infirmary her gait was still noticeably unsteady. The mother, whose attention was called to this peculiarity, said that it was then very much less than it had been during the early part of convalescence. On inspection, a simple otitis media purulenta, with perforation of the membrana tympani, was found on the left side, while on the right the middle ear appeared to be normal.

Finally, to the foregoing cases, in which the injrry was produced by a blow or a fall, may be added the following two, in which the impact of a bullet produced the injury:

Case XII.—The patient, a powerful but idiotic-looking negro, thirty-five years of age, and animated by a desire to end his life, fired one chamber of a loaded revolver into his right ear, and then, finding that he was still alive, he discharged the contents of a second chamber into his left ear. This was done on the 6th of March, 1874, and on the 18th he was brought to the New York Eye and Ear Infirmary. I was not able to learn what had been the man's condition during the interval between these dates. The patient himself was perfectly deaf, and the person who accompanied him simply knew the facts relating to the shooting. On examination I found the right external auditory canal filled with polypoid granulations. These sprang from the anterior and lower wall of the meatus, about midway between the outer orifice and the drum-membrane. At this point the bent probe entered an excavation in which loose pieces of bone were encountered. On the left side the auditory canal was also found to be filled with pus. Several small polypoid growths were removed from the narrow canal, but no region of exposed bone could be detected, nor could I obtain a satisfactory view of the deeper parts of the canal. There could be very little doubt, however, of the absence of the drum-membrane, and probably of the ossicles. The right ear being very painful, I prescribed leeches.

On the 22d of April I saw the patient a second time. The leeches had relieved him from pain. With the slender angular forceps I removed two fragments of bone from the right auditory canal.

On the 2d, and again on the 6th, of May, I removed fragments of bone, one of which presented a blackened appearance.

On the 9th of May I encountered some hard substance in the region of the middle ear, and succeeded in extracting it. It proved to be a mass of lead, about the size of a half-pea, probably a portion only of the ball fired from the revolver. The opening in the canal from which the fragments of bone had been removed presented every appearance of being on the point of healing.

On the 16th of May I removed another piece of lead and some fragments of bone from the region of the right middle ear.

On the 3d of June I found that the wound in the meatus had healed, and that the mucous membrane of the middle ear was free from all evidences of active irritation. The discharge had apparently ceased entirely.

After the removal of the polypoid granulations from the left auditory canal all active discharge from that ear ceased.

If the damage observed in this left ear is to be ascribed to the effects of the

shooting, the bullet must have been extracted by some physician during the period of twelve days that elapsed between the infliction of the injury and the time of entrance into the Infirmary.

In the preceding case it is quite possible that the squamous and petrous portions of the temporal bone (on both sides) were also fractured. The ball, however, may simply have driven the stirrup violently into the vestibule, and not have produced an actual fracture of the petrous bone. In the following case the petrous bone could scarcely have been involved to a serious extent, though probably the squamous portion did not wholly escape.

Case XIII.—The patient, an apparently strong man, thirty-four years of age, and a soldier, was admitted to the N. Y. Eye and Ear Infirmary June 12, 1872. He gave the following history: In the course of an engagement with the enemy, in Val Verde, New Mexico, on the 22d of February, 1862, the company of which he was a member (Co. G, First U. S. Cavalry) was ordered to retake a battery. While they were advancing he was shot in the right side of the head, the ball entering the skin just in front of the ear. The shot had come from a detachment of the enemy in the rear. Three days later the ball was extracted from beneath the skin, just above the right eye-brow. He then noticed a sensation of throbbing and fulness in the right ear, and not long afterward a discharge made its appearance in the outer canal. He remembers also that one of his comrades, at about that time, removed a bunch of hair, clotted with blood, from the right ear. During the first ten or twelve months following the injury he frequently found small fragments of bone in the discharge from the ear. Six months previous to his visit to the Infirmary he had experienced a severe attack of pain in the right ear, but before that time he had always been comparatively free from pain. From the very first he had been annoyed by a tinnitus, like the roaring of a shell. All sounds, moreover, seemed to reach him by way of the left ear. At night he had always been obliged to sleep on the right side, for whenever he attempted to lie on the left side the sense of weight in the right ear became unbearable. About a week previous to his visit to the Infirmary the parts about the right meatus became very painful and swollen. The swelling subsided in the course of a day or two, and then for the first time he discovered the presence of some hard substance filling the outer canal. He came to the Infirmary for relief, and in this way became my patient. On examination of the ear I found a black mass, partly covered by pus, blocking up the entrance to the right auditory canal. I experienced no difficulty in extracting it with the forceps, and on examination found it to be a very much corroded, oblong, leaden bullet, a little over half

an inch in length, and three-eighths of an inch in diameter. The deeper portion of the meatus was found to be filled with a mass of granulations. No sinus could be found, nor any exposed surface of bone. The Eustachian tube was pervious. In front of the tragus there was a depressed scar, indicating the point where the other ball had entered. The patient was unable to hear the ticking of my watch in the right ear. The sound of a vibrating tuning-fork, placed on the central part of his forehead, was referred by him to that point, and not to either ear. With the left ear tightly closed, and the right ear turned toward the speaker, he could understand ordinary conversation at a distance of four or five feet.

On the 15th of June the patient reported that he had been quite free from pain since the removal of the ball, and that the discharge had also ceased.

On the 24th of July he again visited the Infirmary. The discharge had not returned. The tinnitus continued unchanged, but the sense of weight had disappeared, and he was able to lie indifferently on either side. Cicatrization had taken place in the ulcerated portion of the meatus, and there was then a clear but funnel-shaped passage down to the cavity of the tympanum. No trace was found of either the drum-membrane or the ossicles.

At the time when he was wounded, and even up to the time when he visited the Infirmary, the patient supposed that his ear trouble had been caused by the glancing backward of a fragment of the ball which struck him in front of the ear. Even the removal of a tuft of hair from the external auditory canal had not suggested to him the idea of a second ball, until after I had shown to him that the leaden mass removed from the meatus could scarcely be considered as a fragment of the ball that had been extracted from above the eyebrow of the same side. He then stated that many of the men in the enemy's ranks were armed with double-barreled fowling-pieces, and suggested the possibility of his having been shot by the simultaneous discharge of both barrels of such a weapon. A more natural supposition is, that he was shot by two balls contained in a single cartridge—one of them entering the meatus directly, without leaving any external wound, the other striking the bone in front of the ear, and glancing forward.[1]

The complete loss of the hearing power in all these eight cases (I exclude the two last) constitutes the distinguishing feature of this second class. When, in a case of injury to the head, this symptom is discovered shortly after the occurrence of the accident, it is safe to assume, with the knowledge which we at present possess,

[1] For other cases of gunshot wounds of the temporal bone, see Moos: *Archives of Ophthalmology and Otology*, Vol. II., p. 342; Vol. III., pp. 111 and 216: Terrillon; *Annales des maladies de l'oreille*, 1878, p. 249.

either that a fracture has taken place through the labyrinth, or that an extravasation of blood has taken place in the cochlea, without a fracture. The results of numerous post-mortem examinations show that fractures through the petrous portion of the temporal bone, involving the labyrinth, are very common. We have, therefore, good grounds for assuming, in cases such as I have just described, that the total loss of hearing means a fracture of the petrous portion of the temporal bone. At the same time we do not possess a sufficient number of facts to justify us in excluding the possibility of a mere extravasation of blood without fracture. And yet, on the other hand, we possess no facts which show that the blood-vessels of the labyrinth are specially predisposed to rupture under the influence of a mere concussion.

In this connection I should state that in one of my cases the hearing was not noticeably affected by the accident, but later, after meningitis had developed, the child became totally deaf. In this case, which I will narrate in brief outlines, the loss of hearing was undoubtedly due to an extension of the inflammation from the meninges to the labyrinth.

Case XIV.—The patient, a boy eleven years of age and in fair general health, was brought to the Infirmary on Aug. 6, 1872. According to the mother's statement, he had had a fall from a high stoop, on a Friday toward the end of April. After the fall he came home and said that he wanted to go to bed. Condition of hearing and equilibrium not then noticed. That night the mother observed that the boy moaned constantly through the night. The next morning, Saturday, he came down stairs of his own accord, and then the mother noticed that his gait was staggering. That day the hearing was undoubtedly unaffected, inasmuch as the child answered all questions. That night he slept well. On Sunday morning he came down stairs without assistance. Gait still staggering, though not so bad as on Saturday. On Sunday the mother noticed a change in his appearance; his face was very pale, he vomited frequently, and complained of severe pain in the head. The vomiting ceased the same day, but the patient continued to complain of his head and gradually passed into a state of delirium and high fever. Acute symptoms, with delirium and involuntary evacuations, continued for a little more than a week. Convalescence lasted four or five weeks. Staggering gait had continued up to the time when I saw him, but it was gradually growing better, as the mother thought. There had been no discharge from either ear at any time during his life. So far as I could discover, the deafness was absolute. On examination

I found both drum-membranes normal in appearance. I advised the parents to send the boy to some institution for instruction.

In considering the significance to be attached to the different symptoms which are observed in cases of fracture of the temporal bone, we should naturally begin with that of *bleeding from the ear*. This symptom has always been considered of great diagnostic value. It was a prominent symptom in five of my cases. Prescott Hewett, in his article on Fractures of the Base of the Skull,[1] speaks of this symptom of bleeding from the ears in the following terms: "Bleeding from the ears, in severe injuries of the head, has, for many years past, been held, and deservedly too, as one of the most valuable diagnostic signs of fractured base. But this bleeding, to be of any value as a means of diagnosis, must be of a serious nature, and, above all, it must continue for some time. With such a bleeding it may be safely diagnosed that there is a fracture of the base running through the petrous bone,[2] and opening up a communication between the cavity of the tympanum and some of the numerous and large vascular channels which surround this bone, or with an extravasation of blood within the cranium itself." In the statement which I have just quoted, stress is laid, as will be observed, upon both the copiousness and the duration of the bleeding, and we are permitted to draw the inference that if the bleeding is not "of a serious nature," a fracture of the base may not have taken place. Again, in the next sentence, we are told that a copious and prolonged bleeding indicates the "opening up of a communication between the cavity of the tympanum and some of the numerous and large vascular channels which surround this bone, or with an extravasation of blood within the cranium itself." At this point let me state that neither Prescott Hewett's nor my own observations warrant any very positive statements on these points. This whole subject of fractures of the temporal bone needs to be

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[1] Holmes' System of Surgery, Vol. II., p. 284.

[2] The term "petrous bone" is used here, I suspect, not in the strict anatomical sense of the term, but rather with the idea of designating all that more solid portion of the temporal bone which lies below the line of the zygoma (viz., all of the petrous portion proper, a considerable part of the squamous portion, and the osseous auditory canal).

studied afresh. We possess numerous good clinical observations made by surgeons; we possess also the records of carefully made post-mortem examinations; but we possess, so far as I know, no records of cases in which in addition to the facts obtained by the foregoing methods of studying the phenomena of the disease, those obtainable by an examination of the auditory canal, membrana tympani, and middle ear, shortly after the occurrence of the accident, are available for purposes of study. I maintain that in every case of suspected fracture of the temporal bone, such an aural examination should be made, and the conditions observed should form a part of the record of the case. Until this shall have been done in a sufficiently large number of cases, it will not be possible either to confirm or to refute authoritatively the statements which I have just quoted. So far as my own incomplete material furnishes any light upon the significance of bleeding from the ears, I may say that this symptom is susceptible of a somewhat broader interpretation than that given to it by Prescott Hewett. I would add to his proposition the following: *When a fall or blow upon the head is followed by bleeding from the ear, no matter how trivial, we may diagnose a fracture of the temporal bone in the neighborhood of Shrapnell's membrane, and probably in the line of the Glaserian fissure.* By this proposition I mean to convey the idea that, so far as the mere symptom of bleeding from the ears is concerned, we are scarcely justified in assuming that the line of fracture extends beyond the region of the tympanum. The petrous bone may also be fractured at the same time, and a laceration of the lateral sinus, or of one of the smaller sinuses, may have taken place; but the mere fact of a copious hemorrhage from the ear does not, in my opinion, justify us in assuming the existence of any such serious lesions. In the first place, if we concede the possibility of a persistent and copious venous bleeding from the ear, we must assume that an almost gaping communication exists, first, between the middle ear and the venous sinus, and, second, between the middle ear and the external auditory canal. Otherwise, how could venous blood flow freely and copiously from one of the sinuses in the cranial cavity out into the external meatus? I am far from denying the possibility of such an occurrence,

and am even disposed to believe that the case of the machinist, Case II., may afford an example of this very combination of lesions. In the majority of cases, however, a fairly copious and protracted bleeding may occur from a simple laceration of the tympanic artery, such as would be very likely to follow a fracture involving the temporal bone in the line of the Glaserian fissure. As there are no other sources[1] beside the two mentioned, from which a copious hemorrhage in the meatus might come, we must choose between these in any given case. I have very little doubt that a careful examination of the drum-membrane alone, if made before these parts have become inflamed, would aid us very materially in determining the source of the bleeding.

The necessity of such examinations is shown very clearly in those cases of fracture in which no outwardly visible hemorrhage or other discharge takes place from the ear. As all my cases are cases of recovery, I am unable to furnish an indisputable instance of fracture of the temporal bone without hemorrhage from the ear; but Dr. George L. Peabody, the pathologist of the New York Hospital, has very kindly supplied me with such an instance from the records of that institution. The report reads as follows:

James Battersby, æt. 40; Ireland, widower, iron-worker; admitted June 2, 1879. About an hour before admission he fell from a scaffold while at work on the Ninth Avenue Elevated Railroad, a distance of twenty feet, striking his head on the pavement.

He was suffering from shock, from which he rallied after administration of stimulants. On admission he was found in a condition of stupor, and was observed to be absolutely deaf. He could easily be roused, talked intelligibly, and was not paralyzed at all. There was a slight contused wound of scalp, which did not reach the bone, and the history states that "examination of surrounding parts gave no evidence of fracture."

He took but little nourishment, became gradually completely comatose, and died on June 4th, two days after admission. There was a thin watery discharge from the nose, but there were no aural signs except deafness. Before he died the scalp was incised, and a fracture detected.

Autopsy 24 hours P.M.—The viscera of thorax and abdomen were substan-

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[1] The carotid artery is, I believe, only very rarely lacerated in injuries of this kind.

tially normal. The following is the account of the examination of the head as taken from the autopsy book (Case 109):

Beneath dura mater is a thin coagulum, extending over convexity of cerebrum pretty generally. At anterior extremity of left frontal lobe there is a pretty thick clot, which extends into brain substance. Latter is completely broken down, hemorrhage having probably taken place from vessels of brain substance. Sphenoid lobe on same side is in similar condition, as is also posterior extremity of right hemisphere of cerebellum. Ventricles are normal, and in other respects brain is healthy.

There are several fractures of skull, viz.: one beginning in occipital bone in fossa for cerebrum of left side, and extending downward to the right through interior occipital protuberance, aud onward through the fossa for the cerebellum on right side, obliquely to foramen magnum, which it enters on the extreme right of its circumference.

One on the right side, beginning in the foramen lacerum posterius and extending forward through the middle of the petrous portion of the temporal bone, and terminating in the roof of the tympanum. By removing this, the ossicles are found enveloped in a small clot of blood. There is no appearance of hemorrhage in the mastoid cells.

One on right side, starting at anterior condyloid foramen, and extending upward and forward to foramen lacerum posterius.

One on the left side, extending from the inferior maxillary foramen forward through the greater wing of the sphenoid to the foramen lacerum anterius.

One on the left side, through the petrous portion of the temporal bone, extending from the foramen lacerum posterius forward and inward through the roof of the tympanum, and onward to the inferior maxillary foramen, at which point it becomes continuous with the preceding fracture. On removing roof of tympanum ossicles are found as on other side, surrounded by a clot of blood. On this side there are clots in the mastoid cells.

The membranæ tympanorum are not affected, except that they show a slight bulging outward, caused by blood in tympani, as described above.

On careful examination, it was found that the fractures in both temporal bones extended into the semicircular canals, and that on the right side the cochlea contained a clot. The right Eustachian tube is filled with clotted blood.

The symptom of visible bleeding from the ears is not, therefore, a necessary accompaniment of a fracture of the temporal bone. On the other hand, evidence of inflammation of the parts surrounding the drum-membrane affords excellent evidence of such a fracture.

Of the remaining symptoms, which may be ascertained with-

out an examination of the drum-membrane, the most important, after hemorrhage from the ear, is that of a *watery discharge from the external auditory canal.* The significance of this symptom has, I think, been very fairly stated by Prescott Hewett in the article to which I have already made reference.[1] He sums up the matter in these words: "There are, then, as far as is known at present, three classes of cases of this watery discharge. In the first class, where the fluid from the ear is plentiful and of a decidedly watery character immediately after the accident, there need be no doubt as to the nature of the injury—the watery discharge is due to the escape of the cerebro-spinal fluid, which, as already stated, can only take place through a fracture of the petrous bone implicating the internal auditory canal and its membranes.

"In the second class of cases, characterized by a copious and prolonged bleeding from the ear, followed by a watery discharge, a fracture of the petrous bone may also be safely diagnosed; but it cannot be said that the fracture follows any particular course. In these cases it must, however, be clearly understood that it is not to the watery discharge that we can trust for our diagnosis, but to the copious and prolonged bleeding.

"Thus far there is no difficulty. Not so, however, in the third class of cases, in which there is at first a discharge of blood only, neither copious nor prolonged, which is followed by a watery discharge, varying as to the time of its appearance—varying as to its quantity. It may be present within a very few hours after the accident—it may be profuse within a few hours after its appearance. These are the cases in which experience has of late proved that the diagnosis ought to be doubtful. The discharge of blood is certainly not of a character to warrant a diagnosis of fracture of the petrous bone; and as to the watery discharge, it is now well known that such a discharge may occur within a few hours after the accident, that its quantity may even be profuse, and yet there may be no fracture."

Among my own cases there are but two in which the symptom of a watery discharge from the ear was well marked. In one of

[1] Op. cit., Vol. II., pp. 291 and 292.

these a blood-stained watery discharge made its appearance soon after the accident, and continued for at least a week afterward. As the hearing was almost entirely restored in this case, it is safe to assume that the fracture did not involve the petrous portion of the temporal bone, but merely the tympanic or the squamous portion. The watery discharge was therefore probably purely inflammatory in its nature. In the other case a watery discharge was observed shortly after the occurrence of the accident, and continued for at least a week. Inflammation of the meninges then set in, and the discharge soon became purulent. As the hearing power was totally destroyed in the affected ear, it is probable that the fracture involved the petrous as well as the tympanic portion of the temporal bone, and that the watery discharge was due largely, at first, to the escape of the cerebro-spinal fluid. In this connection, however, I should mention a fact with which every aural surgeon is familiar, and which should make us hesitate a long time before we pronounce a watery discharge, no matter how profuse, to be due to the escape of the cerebro-spinal fluid. The fact to which I refer is this: in exceptional cases of acute inflammation of the middle ear the flow of a thin serous fluid from that cavity, after a perforation has become established in the drum-membrane—whether by natural or by artificial means, it matters not—is so copious as to excite very great astonishment. I have known it to soak through several cloths in the course of a night, and to give place to a distinctly purulent discharge only after two or three days had elapsed. Furthermore, the breaking of the bony wall of the tympanum and the consequent laceration of the superjacent soft parts would supply an amply adequate exciting cause for such a high degree of irritation of the tympanic mucous membrane as this profuse watery discharge would imply.

Once more allow me to call your attention to the question of examining the ears of patients supposed to be suffering with fracture of the temporal bone. *The lesions demonstrable by the aid of the speculum and reflected light, in the soft parts immediately surrounding Shrapnell's membrane, furnish us with a valuable means of locating at least a part of the injury done to the temporal bone.* If a fracture or diastasis has occurred in the line of the Glaserian

fissure, we should find either an actual solution of continuity in the soft parts, or a spot from which blood is escaping; or, if one or two days have elapsed since the occurrence of the accident, we should not fail to find well-marked evidences of inflammation in the vicinity of Shrapnell's membrane, or along the anterior portion of the upper wall of the bony canal. The rent in the soft parts may even involve the drum-membrane proper. On the other hand, all evidences of this local inflammation may disappear as early as during the fourth week following the accident.

In this connection the question naturally suggests itself, why may not the inflammation of Shrapnell's region, or the escape of blood from some point in this vicinity, or even an actual rent in the soft parts, owe its origin to something else beside a fracture or diastasis of the neighboring bone? In the light of this question let us examine some of these cases of assumed fracture in the neighborhood of the middle ear. For example, in the second case which I have reported in this paper, the patient received a blow on the right side of the head, and the hemorrhage took place from the auditory canal of the same side. In this case, therefore, the hemorrhage might possibly have come from some superficial blood-vessel which had been ruptured by the violent concussion of the air in the auditory canal. In the first case, however, this explanation would be considered, to say the least, far-fetched. The man was struck on the top of his head by a falling plank, and blood escaped from one ear. In the third case the patient fell and struck upon the left side of the head, but her symptoms thenceforth all pointed to some serious damage done to the opposite ear, and inspection, four days later, showed it to be the seat of two significant lesions—inflammation of the parts near Shrapnell's membrane, and an extravasation of blood in the middle ear. In both of these cases there can certainly be no question of a violent concussion of the air in the auditory canal, and we are obliged to seek for some other cause. A fracture of the bone near Shrapnell's membrane, affords, as it appears to me, the only satisfactory explanation of all the phenomena observed. A fracture of the bone in this particular locality, where the soft parts are tense and inelastic, means, at the same time, a rupture of these soft parts. If the fracture follows the line of the Glaserian fissure—

and in many of the cases this is probably the course which the fracture takes—we have a right to expect that in a certain proportion of them the tympanic artery, which lies in that fissure, will be torn. The copious bleeding from the ears, which is so often observed in these cases of fracture of the base, owes its origin, I believe, quite as frequently to the tearing of this artery as to the laceration of one of the more remotely situated venous sinuses. An artery that is surrounded by bony walls is more likely, when ruptured, to bleed for an unusually long time, than one whose muscular coats have an opportunity to contract and retract.

Thus far I have considered only those symptoms and visible lesions which point to fractures in two parts of the temporal bone, viz., the petrous portion and the tympanic portion. There are other symptoms, however, which enable us to still further define the course which the fracture may have taken. Thus, for example, in one of my cases there was *facial paralysis* on the same side as that on which the hearing power had been destroyed. It was discovered shortly after the occurrence of the accident, before inflammation could have set in, and was undoubtedly due to the direct effects of the violence. The simplest explanation would be that the line of fracture involved the facial canal, which lies just above the oval window.[1] In another case the patient experienced considerable difficulty in swallowing. Without more accurate data than those which my notes of the case furnish, I can scarcely express an opinion upon the significance of this symptom. In a case of fracture of the base, recently seen by Dr. L. Putzel, of this city, the patient made precisely this same complaint; and, on closer scrutiny, the doctor discovered that the difficulty experienced was not in swallowing, but in masticating the food taken into the mouth. The masseter and temporal muscles of one side were paralyzed, and the patient was unable to protrude the lower jaw straight forward. The inference which he drew from this condition was, that the fracture had not merely involved the central portion of the pars petrosa (the patient had entirely lost the hearing in one ear), but had probably extended down to the very apex of the bone, causing

[1] See Eysell: Archiv für Ohrenheilkunde, Bd. VII., p. 208.

injury to motor filaments of the fifth nerve. Finally, in the second case mentioned above, the combination of symptoms points, I believe, to a fracture not merely involving the tympanic or the squamous portion of the temporal bone, but extending probably through the posterior wall of the tympanum down to the lateral sinus, and perhaps even causing a rent in its walls. The daily chills, fever, and sweating; the development of a cough on the fifth day, and the profuse muco-purulent expectoration which soon became associated with it; the flushed face, prominent veins of the head and neck, and marked stupor; perhaps, also, the tenderness on pressure in the mastoid region—all these symptoms, it appears to me, are to be explained upon the assumption that a fracture, involving the fossa sigmoidea, caused a phlebitis of the lateral sinus, and this in turn gave rise to the pyæmic manifestations, and then to those of interference with the venous circulation (drowsiness and fulness of the veins).

It is a great mistake, it seems to me, to think that nothing is to be gained by an examination of the ears, in such cases, beyond the establishment of the diagnosis upon a somewhat firmer basis. The first examination will, as a matter of course, accomplish this result, but subsequent examinations, if made at proper intervals, should in many cases enable the surgeon to materially modify the severity of the inflammation which is almost certain to follow the violence done to the parts lying along the base of the brain. The timely establishment of a free opening in the membrana tympani, incisions in the inflamed and tense tissues in the neighborhood of Shrapnell's membrane, the free use of leeches and the warm douche—are not all these measures just as likely to be efficacious in a traumatic inflammation of the middle ear as in one of different origin? and may not the abatement of the inflammation in this limited area be sufficient to turn the scale in favor of recovery?

REFLEX ULCERATION IN THE EXTERNAL AUDITORY CANAL, WITH PERFORATION OF THE MEMBRANA TYMPANI, PRODUCED BY DISEASED TEETH.

By CHARLES HENRY BURNETT, M. D.,

PHILADELPHIA.

In July, 1878, Mrs. B. P., aged forty, consulted me in reference to a discharge from her right ear, which had annoyed her for some time. Her statement was, that the discharge had set in after an attack of not severe earache some months previous; that the discharge then grew slowly less, when another attack of pain in the ear was followed by an increased discharge, again to diminish and again to increase, after the now usual attack of pain. The hearing had at no time been affected to any extent, being only slightly dulled sometimes, apparently by retention of small quantities of discharge. The latter had never been very great, and the chief annoyance seemed to be the recurrence of pain and the odor of decomposing matter in the ear. There had been some ear disease on this side after scarlatina in childhood, but the ear had healed, and had remained a good one until quite recently, when the above symptoms showed themselves. The patient had no reason to assign for her aural disease.

Upon inspection, the membrana tympani was found perforated in the inferior posterior quadrant, at which point there were some small granulations.

The posterior wall of the auditory canal, near the membrana tympani, was ulcerated, showing a granulating spot, and the fundus of the canal was bathed with light-colored pus. The Eustachian tube was easily inflated by Valsalva's method, and the perforation-whistle readily obtained. The mucous membrane of the tympanic cavity, seen through the perforation after the ear was cleansed, appeared healthy, thus showing that the disease was chiefly confined to the outer surface of the membrana tympani and the posterior wall of the canal: in fact, it suggested itself to me that the disease might have originated in the canal and spread to the drum-head; but it did not occur to me until after prolonged treatment, that the disease in the ear might be *purely reflex, and due to several diseased teeth in the lower jaw on the right side*, as it finally was shown to be.

The granulations above alluded to were touched with saturated solution of nitrate of silver, by means of cotton on a cotton-holder. Ten days later the

patient was seen again, when only a little powdered alum was blown into the ear, and in five days more the discharge had ceased, the granulations had disappeared and the perforation in the membrana tympani had healed. A red spot was still seen on the posterior wall of the canal, where the ulceration had been. A week later the patient called, stating she had had an attack of the old pain, followed by a little discharge, and the membrana tympani was found to be again perforated at the old spot. This time no application was made, but the patient was told to use a douche to the ear, of warm water and laudanum, if the pain returned. As no pain occurred, no syringing or douching was done, and in two days aspergillus was found in large quantities in the external auditory canal, having sprung up upon the decomposing secretion. The patient was now told to use equal parts of alcohol and water, ten drops thrice daily in the ear, as a parasiticide. This was continned for three days, during which the fungus was destroyed, though some earache of a dull kind continued. As a preventive of a re-growth of the fungus, the alcohol treatment was continued thrice daily for two weeks longer. The ear became comfortable, though a little discharge still seemed to come from the formerly ulcerated spot, on the posterior wall of the canal, but the ulceration was much less evident otherwise.

The ear now remained comfortable for nearly a month, when, as a little discharge still existed, a few drops of a solution of nitrate of silver (60 gr. to f ℥ j.) were applied to the canal. Six days later, as a little discharge yet showed itself, the same kind of application was made again, and during this time the patient syringed her ear daily once or twice at home. There was now no perforation in the drum-membrane.

The discharge was now so slight as not to demand syringing at home, which was therefore stopped and a few drops of the following mixture were dropped into the ear:

℞.	Liq. plumbi subacetatis	♏ xx.
	Acidi acetici dilut..........................	♏ vi.
	Liq. opii sedativi............................	♏ xx.
	Aq. destill. ad................................	f ℥ j.

This had the effect of drying all discharge in a few days. Its use was kept up for a fortnight, when the ear was again inspected. It was found to be much better in appearance in every way. There was no sign of discharge, the fundus was rather *red*, aud the membraua tympaui was *congested* posteriorly, but dry and scaly. The anterior half of the drum-head was gray and looked opaque from previous inflammation. The hearing was good, in fact it had never been impaired. At this visit, though the objective symptoms were good, the patient said she had had some of the old pain, which she had felt so often aud knew so well as a forerunner of renewed ear-discharge. A casual remark about her teeth, viz.: that they had long given her discomfort,

led me to look into her mouth, and on the right side of the lower maxilla, the *first and second molars were seen to be largely decayed and the gums about them inflamed and sensitive.*

This right away furnished a clue to the origin and stubbornness of the disease in the ear. At once these teeth were extracted, all discomfort in the mouth ceased, and from that *day to this, two years, no pain nor any other symptom of aural disease has shown itself.* On Oct. 28, 1878, nearly four months from the time the case was first seen, I made the following note in my case-book: The membrana tympani is opaque and lustreless, but pale, dry, and smooth. Near the membrana, on the posterior wall of the auditory canal, where the old ulceration was, there is now a round, flat hillock, shining, pale, and covered with skin like the rest of the canal. This was not touched with a probe; but it was most probably a small exostosis at the seat of the old ulcer, showing how deep the erosion had been, even down to the bony wall of the canal.

Etiology.—The connection between teething and earache in young children has long been observed and is mentioned by both general and special writers. Among the latter Rau has written at some length on the subject, stating that in many instances "each new tooth, as it cuts its way through the gum, is attended by a mild form of external otitis, characterized by a mucoid secretion" (Ohrenheilkunde, sec. 168. Berlin, 1856).

In my own treatise on the ear,[1] the statement may be found, that so frequently is earache an attendant of this period of childhood that mothers have been known to prophesy with accuracy the coming through of a new tooth, on account of the sudden attack of earache, and I may add slight discharge from the ear, in their children.

In some instances we may find that the catarrhal inflammation —muco-purulent in its results—has passed into an acute purulent form of tympanic inflammation attended by perforation of the membrana tympani.

At page 90, of the work alluded to, I have endeavored to give the nervous supply of the ear in all its parts, and it will be there seen that by means of the otic ganglion a nervous connection is established between the ear and the teeth. It may be briefly traced as follows: "The nerves supplying the mucous membrane

[1] Philadelphia, 1877, p. 375.

of the tympanic cavity, as well as that of the Eustachian tube and mastoid cells, are derived from the tympanic plexus, an anastomosis between the *otic ganglion*, petrosal ganglion of the glossopharyngeal nerve, and the carotid plexus, by means of the superior cervical ganglion of the sympathetic. Now, by means of the *otic ganglion*, the soft palate, the drum-head, and the tensor tympani muscle, the lining mucous membrane of the cavity of the drum and the integument of the external ear, are put into sympathetic relation with each other and other parts of the nervous system. For the *otic ganglion* is situated on the inner side of the sensory division of the inferior maxillary nerve and sends branches to it. It is important to bear these relations in mind when considering certain neuralgias—and I may add inflammations—in and about the ear, which might otherwise prove very puzzling.

Before I had thus set forth these important anatomical and physiological connections between the mouth and the teeth, Dr. J. Orne Green had contributed largely to our knowledge of the reflex relation existing in some cases of neuralgia, between the mouth and the teeth.[1] But his valuable contribution referred to reflex neuralgia only: not to a trophic lesion of any part of the ear. For he says: "The diagnosis of neuralgia of the ear can only be made after a thorough examination of the ear itself has excluded all disease of that organ: for if any such disease exists it is most probably the cause of the pain, ... and although we can imagine a continued neuralgia of the tympanic plexus finally affecting the nutrition of the middle ear and so causing subjective noises, we have no means of distinguishing such defective nutrition from simple inflammation of the middle ear, etc."

In the explanation of the case I have given at the beginning of this paper, it seems not difficult to go a step forward in the application of the law of reflex action, for as it can be shown that *reflex neuralgias* can be produced in the ear by the irritation from diseased teeth and gums, so it can be also shown that tissue-changes, such as inflammation and ulceration in the ear, can be evoked in a similar way. And in this connection it gives me pleasure to point

[1] Transactions American Otological Society, 1875, p. 561.

to the works of Dr. Edward Woakes,[1] of London, and Dr. Samuel Sexton,[2] of New York city.

It may be stated in a general way that *the effect of any irritation in a vaso-motor nerve-tract may be to excite vessel-dilatation, through diminished inhibitory nerve-power, in a correlated area.* Thus an irritation proceeding from diseased teeth and gums may be to excite waves of vessel-dilatation in the correlated area of the drum-cavity, the drum-head, or in the *external auditory canal.*

Since, in the case under consideration, the reflex disturbance was excited chiefly in the external auditory canal, it will be best to first trace the nervous connection between it and the diseased teeth. The blood supply to the auditory canal is derived from the external carotid artery, by its branches the posterior auricular, etc., and the vaso-motor nerves controlling the calibre of these vessels is derived from the external carotid plexus of the sympathetic.

The diseased teeth are supplied by the inferior dental nerve.

The task before the diagnostician is to show how irritation of filaments of the inferior dental nerve can be communicated to the external auditory canal so as to bring about trophic changes in that part of the ear. Let it be well borne in mind that the large or sensory division of the inferior maxillary nerve, from which the inferior dental nerve arises, is connected on its inner side with the *otic ganglion.* This ganglion is connected with the plexus of the sympathetic distributed to and over the external carotid artery. As branches of this artery supply the external auditory canal, it is easily seen how this part of the ear becomes an area correlated to the point of irritation in the diseased teeth, through the medium of the *otic ganglion.*

Now, as the result of irritation at one point in a vaso-motor tract is to suspend the inhibitory power of vaso-motor nerves in a correlated area, the vaso-motor nerves, *i. e.*, the branches of the carotid plexus regulating the supply of blood in the external ear, lose for the time their power of controlling the calibre of these vessels, on account of the irritation conveyed to them from the

[1] Deafness, Giddiness, and Noises in Head. Philadelphia, Lindsay & Blakiston, 1879. Second edition, 1880.

[2] Prize Essay; see American Journal Medical Sciences, Jan., 1880.

teeth *through the otic ganglion.* The vessels therefore become distended, and pain and inflammation are the result.

A similar condition of altered blood-supply may ensue in the drum-head, through the connection existing between the inferior dental nerve, the otic ganglion, and the *internal* carotid plexus. In this instance the blood-supply of the drum-head, from the tympanal branch of the internal carotid, may have been augmented through a loss of inhibitory power in the vessel. In the tympanic cavity a similar state of altered blood-supply may ensue upon irritation conveyed over a nervous area, the components of which are the tympanic nerve or plexus on one side, the *otic* ganglion, as a medium, and the inferior dental nerve on the other side.

The application of this law of reflex action to the case I have narrated is easy. The diseased molars so irritated the filaments of the sympathetic nerve contained in the external carotid plexus, as to curtail their power, vessel-dilatation then ensued in the correlated area, the external auditory canal, and ulceration took place, as may be seen by referring to the notes of the case. In this part of the ear the greatest reflex irritation occurred, as may be known by the more extensive disease, resulting in a small exostosis, and also by the obstinacy of the ulceration in the canal.

The next part which became diseased by its vessels becoming deprived of the inhibitory control of the vaso-motor nerves, appears to have been the membrana tympani, for it was perforated when the case was first seen; it then healed, and yet a second time opened, and again healed. Here the vessel-dilatation was not as great as in the canal, for the disease yielded more easily to treatment, as shown by the repeated closing of the perforation.

The tympanic cavity was least affected, for, had it been more diseased, or even relatively as much as the auditory canal, greater pain and hardness of hearing would have been prominent subjective symptoms, and greater congestion of the mucous membrane in the drum cavity could have been seen. In fact, in view of the almost entire absence of tympanic disease and the comparatively slight disease in the membrana tympani, it might be held that the vaso-motor nerves most implicated—perhaps the only ones—were those controlling the vessels of the auditory canal, and that the ulcer-

ation and perforation in the drum-head took place primarily in the dermoid layer of the membrana tympani, which is really part of the skin of the auditory canal, and hence supplied by the external carotid artery. This seems all the more probable because the anterior half of the drum-head was never congested, as it and the rest of the membrana would have been to a marked degree, had the tympanal branch of the internal carotid artery been largely deprived of its inhibitory control.

It will be seen, by referring to the notes of the case given, that though the ear would become much better under treatment, the external auditory canal never got entirely well until the two diseased molars were extracted; and then the entire ear became well, and has remained so ever since.

A NOTE ON THE AURAL PHENOMENA PRODUCED BY CHENOPODIUM POISONING.

By SAMUEL SEXTON, M.D.,

NEW YORK.

In the July number of the American Journal of Otology, Dr. North reported two cases of poisoning by this drug, in both of which there were the symptoms of deafness and tinnitus aurium. Concurrently with the above, a somewhat similar case was reported in the *Maryland Medical Journal* of July 1, 1880, by Dr. Pole. In the latter case the patient was a girl about two years of age, who was given a teaspoonful of worm-seed oil. After having taken the drug she vomited. The patient was seen by the doctor some hours afterward, who found her lying on a lounge in a deep sleep, and with a cold, clammy perspiration on her brow. Her breath had the odor of worm-seed oil. The child seemed much prostrated, the pulse beating rapidly—120 beats per minute. She was given some brandy in milk, after which the pulse was found to be reduced to 80 beats per minute. In the course of an hour or so she became very restless, and would occasionally scream out. Small doses of bromide of potash were given, which had a very soothing effect, and the patient passed a good night, sleeping and breathing regularly, and only waking occasionally to ask for water. The skin and physiognomy were natural.

The next morning she was found to be very irritable and cross. She would not permit any one but the mother to touch her. She could neither walk nor stand alone, but when supported would stagger along. In the afternoon the restlessness and irritability increased, and when the doctor called she seemed to be suffering from pains in the abdomen. An injection was ordered, which caused a free evacuation of the bowels. She vomited several times during the day, the egesta each time smelling strongly of the

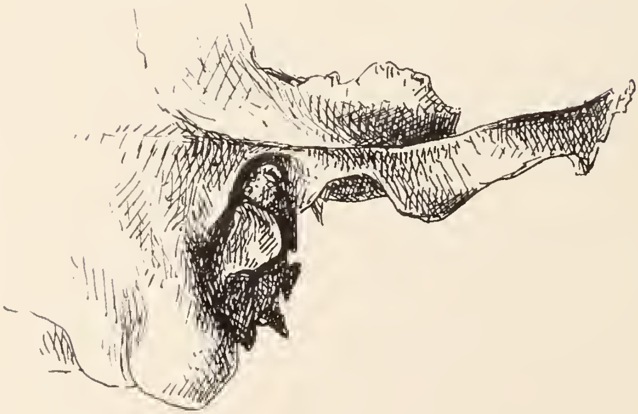
oil. Occasionally she would put her hand to the head and complain of pain. She was now given bromide and iodide of potash at regular intervals. On the third morning of the attack she was found playing about the room, apparently well. The mother now called the doctor's attention to an impairment of hearing which she had detected. The medicine was continued, and on the fourth day she was found to be quite restless and wanting to lie down all the time; the deafness, however, was no longer perceptible. The medicine was continued until the next day, when she was as well as ever, except the cold which she had been complaining of previously.

This case has a striking resemblance to those reported by Dr. North, and there was in fact in all of these cases the same marked cerebral disturbance and decided anomalies of audition. From the description of the aural symptoms, it may be inferred that the medicine has a somewhat specific effect on the middle ear. In the younger subjects, tinnitis aurium was probably present, but it is always found to be difficult to obtain a reliable description of this symptom in such subjects. That auditory vertigo also existed may well be suspected, although in young subjects this symptom is almost as difficult of diagnosis as tinnitus aurium. Vomiting ensued soon after the drug was swallowed in two of the three cases, which may account for their more rapid recovery as compared with Dr. North's first mentioned case, which was under treatment for about two weeks.

The literature on the subject of chenopodium poisoning is not very extensive, when it is considered that the drug has such an extensive use as a domestic remedy. Allen, in his *Encyclopedia of Pure Materia Medica*, vol. x., p. 457, has collected four cases, one of which, owing to the prominent aural symptoms present, has an interest in this connection. The case was reported by T. R. Brown, M.D., in the *Maryland Med. Jour.*, November, 1878, p. 20. Mr. X., æt. thirty one years, took about one and a half ounces of worm-seed oil, and thirty drops of turpentine, death in five days. He had nausea, and in walking staggered like a drunken man. There was deafness to the sound of the voice, but exquisite sensitiveness to the sounds of passing vehicles, their vibrations resembling the discharge of

canons. He had tinnitus aurium ("buzzing in his ears"). He finally became so deaf that it was impossible to talk to him, although the sensitiveness to sounds remained as before. He recognized the sound of the tea-bell, although he was in the third story, three flights from where the sound came. He also had aphasia. On the last day of his illness there was more or less regurgitation of yellow frothy material from the mouth, which, like the evacuation from his skin smelled of worm-seed. After experiencing severe convulsive attacks he died in a profound coma.

From the marked influence that chenopodium anthelminticum appears to have on the organ of hearing, as evinced by the deafness, tinnitus aurium, and other aural symptoms in the cases cited above, we should be led as otologists to inquire further into its physiological action on the ear, as it is possible that a careful study of this relationship might lead us to some useful applications of the drug.



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ON THE OCCURRENCE OF EXOSTOSES WITHIN THE EXTERNAL AUDITORY CANAL IN PREHISTORIC MAN.

By CLARENCE J. BLAKE, M.D.,

BOSTON.

II.

In continuation of the investigation, an account of which was published in No. 2, Vol. II., of this journal, an examination was made of thirty-seven additional crania in the collection of the Peabody Museum, Cambridge, Mass.

Of these crania, all in a good state of preservation, thirteen were from the Rose mounds, twenty from the Neeley mound, and four from the Robinson mound, St. Francis River, Arkansas.

Exostoses of the auditory canal were found in six of the thirty-seven crania, or about seventeen per cent., as compared with eighteen per cent. in the crania of the mound-builders from the Cumberland Valley, Tennessee, previously examined.

The average diameters of the canals in the thirty-seven crania, including the canals in which there were exostoses, were: vertical diameter, 11.2 millimetres; antero-posterior diameter, 6.5 millimetres. The average of the diameters of the canals in which exostoses were found was: vertical diameter, 12.3 millimetres; antero-posterior diameter, 6 millimetres.

Of the six cases of exostoses, all of which by the way occurred in crania taken from the Neeley mound, one (cranium No. 21,198) is especially worthy of mention, both on account of the peculiar forms assumed by the double exostoses occurring in both canals and because of their unusual size. The peculiarity in form in this case would seem, on closer examination, to lie rather in an exaggeration of the usual forms assumed by the two shapes of bony growths which have their location, almost distinctively, it would

seem, the one upon the posterior and the other upon the anterior wall of the canal. The skull in question is somewhat larger than the others with which it was found, and the average diameters of the two auditory canals are: vertical diameter, 13 millimetres; antero-posterior diameter, 8 millimetres.

The entrance of each canal is nearly closed by the bony growths the dimensions of which are as follows: in the right ear the rounded exostosis on the posterior inferior wall is 9 millimetres broad at its base and projects 8 millimetres into the lumen of the canal. The peculiar nipple-shaped exostosis on the anterior superior wall arises from a broad elevated base and projects in the direction of the superior wall, above and toward the rounded exostosis, to a distance of 5 millimetres.

In the left ear the two exostoses are smaller, but similar to those in the right ear in shape and general position; the rounded exostosis on the posterior wall is 6 millimetres broad and projects 5 millimetres, and the nipple-shaped exostosis projects but 4 millimetres, this measurement including the well defined tabular base, 3 millimetres broad.

So far as a single observation is of any value the fact that out of thirty-seven crania the six possessing exostoses came from one of three mounds, even though that mound furnished twenty of the thirty-seven specimens, is worth remarking in connection with the possibility of a family tendency to affections predisposing to these growths.

As in the crania previously examined, careful search was made for evidences of syphilitic disease, and the negative evidence in this respect was fully confirmed by the examination of such of the long bones as were found in these same mounds, made by Dr. E. H. Bradford, who, while finding sufficient evidence of such inflammatory processes as might be expected in consequence of diseases incurred by exposure and from injury, found nothing which could be determined as evidence of syphilitic disease.

For the drawing outlined by Broca's stereograph, illustrating this paper, I am indebted to the courtesy of Prof. F. W. Putnam, who, in a note accompanying the drawing, directs attention to a slight addition to the bony anterior wall of the left ear, while in

the right ear there is a proportionate loss of bone at the same part, this loss being evidently not the result of fracture.

In the following tabular statement, as in that previously given, the numbers are those marking each skull in the Peabody Museum collection.

TABULAR STATEMENT.

MOUND-BUILDER CRANIA.

21,329 *Brachycephalic* L. A flattened exostosis on the superior anterior wall 4 millimetres broad and 1 millimetre high.

21,260 *Brachycephalic* L. On the anterior wall two flattened exostoses, respectively 2 and 3 millimetres broad.

21,264 *Brachycephalic* R. On anterior wall a flattened exostosis 3 millimetres broad; on the posterior wall a narrow flattened exostosis extending inward along the canal, 2 millimetres broad.

21,246 *Brachycephalic* R. On anterior wall two small flattened exostoses.

21,334 *Brachycephalic* R. On posterior wall a flattened exostosis projecting 1 millimetre and 3 millimetres broad.

21,198 *Brachycephalic* L. On posterior wall rounded exostosis 6 millimetres broad, projecting 5 millimetres; on anterior superior wall a nipple-shaped exostosis 3 millimetres broad and projecting 4 millimetres. R. On posterior wall a rounded exostosis 9 millimetres broad and projecting 8 millimetres; on anterior superior wall a nipple-shaped exostosis projecting 5 millimetres.

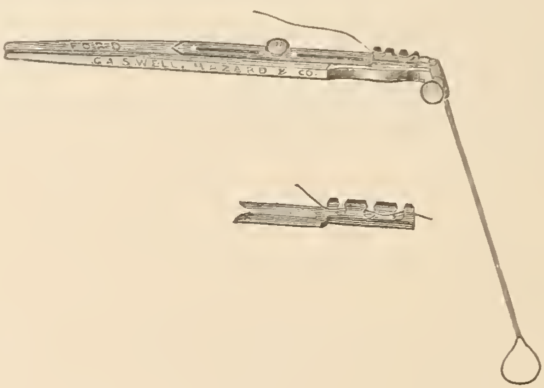
NEW AURAL INSTRUMENTS.

I. Polypus Snare.—II. Foreign-Body Forceps.

By SAMUEL SEXTON, M. D.,

NEW YORK.

In the New York *Medical Record*, October 25, 1879, I described an aural polypus snare, that was found on trial to be both useful and convenient, but its expensiveness was an objection: to obviate this, one more simple in design, and which, moreover, when completed, was found to possess other advantages over the first, has been devised. In the new instrument I have omitted the rather



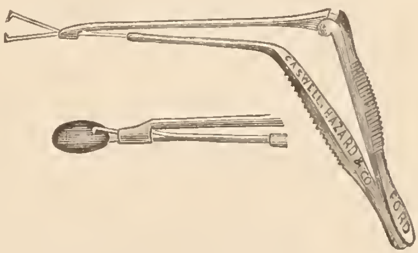
complicated method of securing the wire to the slide, which, in operating, is drawn down by the thumb in the movement that ligates the polypus, and have substituted therefor a very simple contrivance for fastening the wire. In most of the instruments in use for this purpose, I have found that the wire could not be made secure without considerable trouble; and in instances where more than one effort was required to remove the growth, time was also lost in readjusting the instrument. This objectionable feature seems to be overcome in great measure by the instrument under

consideration—the wire being caught by a very simple expedient, that consists in giving it three abrupt turns through notches cut rather deeply in the slide for its reception. The woodcut makes any further description unnecessary.

The Aural Foreign-Body Forceps was devised to remove impacted bodies from the meatus externus, in such cases as the following:—where the foreign body is too large to be successfully seized by passing the blades of the forceps between it and the walls of the meatus; where swollen tissues closely embrace the object; or where the substance to be removed is smooth and hard, and eludes the grasp of the forceps in ordinary use: such objects include peas, beans, and a great variety of seeds, etc., that are often introduced by children into the ears. Glass beads and the like, it may be stated, could not be so well seized by this instrument.

It is well known to those who have made attempts to remove foreign bodies from the ears, that the greatest care is necessary in efforts to seize the object, to avoid pushing it further and further into the meatus at each effort, for in nearly all instances where it is not thought advisable to etherize the patient, he is sure to struggle during the operation.

The instrument I have devised was suggested by my army experience in the use of bullet-forceps, with a tooth-like bite. I have substituted needle points for these, setting them at such an angle, however, that when closed *against* a presenting surface, of whatever shape, they seize it, the needles sinking into it without requiring the exertion of any force that



would push it further inwards. The instrument is made to seize an object by a sliding ring, which glides down over the blades to the point, when the handle is pressed between the thumb and fingers; the points are thus firmly held together, without any of the slipping or bending to which the blades of ordinary forceps are liable. When the needles are firmly locked together, traction may be made to almost any extent desired without tearing them out,

unless, indeed, the substance seized is very soft or brittle. The blades of the forceps have the well-known construction that enables them to revolve in the handle, thus allowing an object, when in the process of removal, to adapt itself to the conformation of the meatus. The attachment by the two points, when they are closed together, provides an axis, upon which the foreign body can also move from side to side, with great freedom, during the act of extraction. This would not be possible if the instrument possessed more than two points.

This instrument, it is believed, will be found of service in a certain number of cases where other instruments fail to meet the requirements.

CLINICAL OBSERVATIONS.

Three Cases of Sudden Deafness from Syphilis. Samuel Sexton, M.D., New York.—Since the publication of my paper[1] on this subject, more than a year ago, I have had the opportunity to observe and record two cases of this variety of disease, and I have also completed the history of another case where the diagnosis of syphilis was not made when the patient first came to me four years ago. Inasmuch as my paper on this subject was based on the somewhat limited experience that a few cases afforded, I trust that the rather lengthy report of the three I now bring forth will not be devoid of interest, or prove tedious to the reader. Writers on the subject remain divided in opinion as to the seat of the lesion in these cases: from my own observations, so far, I still retain the belief that the principal lesion is confined to the transmitting structures of the middle ear, and in this belief I am supported by the researches of the eminent writer on venereal diseases, the late Dr. Freeman J. Bumstead: referring to the "sudden deafness produced by syphilis," he says:[2] "Under this somewhat obscure heading, it is intended to include a certain class of cases, in which sudden deafness occurs apparently as the result of syphilis, but the pathology of which is not known with absolute certainty.

"These cases may occur at any period of secondary syphilis, but are most common within the first three or four years. These attacks are usually preceded by a state of hyperæmia of the drums, either from cold or from sympathy with the mouth or throat, thus inviting, as it were, an invasion of the drum by the specific affection.

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[1] *Vide* the Sudden Deafness of Syphilis. Samuel Sexton, M.D. The American Journal of the Medical Sciences, July, 1879.

[2] The Pathology and Treatment of Venereal Diseases, by Freeman J. Bumstead and Robert W. Taylor. Phila., Henry C. Lea. Fourth edition, 1879, p. 732.

They are characterized by their sudden occurrence and by the extreme amount of deafness." The literature of this subject is, as yet, rather limited, but it is to be hoped that research in this field, especially as regards labyrinthine pathology, may be stimulated by the interest already excited. The first case, as will appear in its history, occurred before my attention had been drawn to the influence that syphilis exerts in middle ear affections.

Constitutional Syphilis. — Facial Paralysis. — Sudden Deafness. — Case I.—J. C., æt. 45, by occupation a carpenter, came to the New York Ear Dispensary September 19, 1876. His health had always been fairly good. His mother had died of paralysis at the age of seventy-eight; a brother died suddenly of heart (?) disease, at forty; a sister died of consumption at thirty. Two brothers are living, one of whom, aged thirty, is quite deaf from the effects of otitis media chronica. The patient gives the following history of himself: Some two years aud a half ago he began to suffer greatly from pains in his head, which sometimes extended to the back of his neck, and even lower down the spine. With these symptoms there was experienced extreme vertigo. In walking on the pavement he was frequently compelled to hold on to railings, etc., to keep from falling. These symptoms lasted six months, when an attack of hemiplegia occurred, affecting the whole left side of the body. Bell's palsy of left side was also present. Following this attack there was complete deafness of the left ear. It cannot be certainly established whether the deafness was very sudden or not, inasmuch as the right ear was unaffected; but it is known that in a few months he was absolutely deaf in the left ear. His physician, Dr. E. Darwin Hudson, in the treatment of the case, resorted to the use of the Faradic current with decided success, and he recovered from the paralysis. He was, however, for some six months unable to work, but from this time on he could walk pretty well and work at his trade. The continuance of vertigo prevented him from ascending to a height or working on the scaffolding of a building.

On November 15, 1875, about one year subsequent to the above, while walking on the street, feeling a little dizzy, he suddenly experienced deafness in his right ear; it came, as he himself expressed it, as "quick as a flash." He was now absolutely deaf.

On December 15th he was admitted to Bellevue Hospital, where he remained for six months, during which time there was no improvement in his hearing. During this attack he had neither pains in the head or hemiplegia, but he had Bell's palsy of the right side of the face.

At the present time he suffers from vertigo, a symptom from which he has not been entirely free since the first attack. He staggers very much when walking, and without assistance he would not be able to avoid stumbling off

the sidewalk. He has pharyngitis, and the tympanic membranes are lustreless and retracted. Hearing: when shouted at he can hear a noise, but is unable to distinguish words. By means of tissue-conduction—through bone, muscle, etc.—he hears a vibrating tuning-folk. He hears his own voice, but the perception of it is not as distinct as in the normal condition; he therefore talks in a tone higher than ordinary. He is now very despondent and forgetful; his general health is very fair, although he has a rather poor appetite; his pulse is 64, full and regular. Inflation of the drums takes place when Valsalva's method is practiced, and even more freely when the Eustachian catheter is used. The air in the external *meatus* was alternately rarified and condensed by my instrument for this purpose, with the hope that this method of gently but firmly causing oscillations of the conductive mechanism would possibly, in some measure, break up the adhesions; but all of these efforts were unavailing. In order to give tone to his nervous system, a solution of phosphorus was ordered on September 26th.

October 23d.—Discontinued the mixture, as it seemed to be of no benefit to him. For the past week he has had twitchings about the eyes and an increase of the vertiginous symptoms. Several times daily he feels weak, and is then apprehensive of a fit; indeed, at such times, he must hold on to some object to avoid falling. He now has tinnitis in left ear, like "bees fighting," and in the right like escaping steam. Hearing absolutely nil. He was given bromide of potash.

October 28th.—The noise in left ear is described as "like fire-crackers." The vertigo still present, but he thinks he does not stagger quite so much as he did.

October 30th.—Last night he experienced a sudden pain in the frontal region, and at times he wept. At eight this morning he had a fit; his eyes were set; his teeth were clenched. I called at his house at nine A.M. and found that he had recovered from the attack. Pulse 60 and regular. He feels very weak. He was given—℞. Potas. bromidi, grs. xv., three times a day.

He called at the dispensary and reported himself as feeling better. He has, however, an increase of tinnitus aurium, the noise in the right ear resembling voices at one time; at another time the singing of mosquitoes. Treatment continued.

November 11th.—Tinnitus has ceased, he feels very well. He fancies sometimes that he can hear the bells and horns used by street venders; they were formerly not heard. ℞. Pot. brom, gr. x.; Potas. iodidi, gr. v.; Ammon. mur., gr. v. ♏. Three times a day: taken in water.

His eyes were now examined by Dr. Derby with the ophthalmoscope. He discovered nothing abnormal in the optic nerve or retina.

February 14, 1877.—General health good, but some vertigo at times. The

tinnitus has not been bad, although there is a constant roaring in his ears. On the street he hears the noises of vehicles and street cries, but they are indistinguishable.

When last seen, on June 14th, he experienced occasional twitchings about the eyes and had some dizziness.

This patient's deafness, as before stated, was not associated with syphilitic disease, my attention at that time not having been drawn to the rapid progress of deafness in such cases: subsequently, however, I concluded to re-examine the case. On being sent for he came to my office on December 18, 1879. Close questioning elicits the statement that he had gonorrhœa in 1863, but he denies having had any subsequent exposure to women of the town, although he had lived with a woman to whom he was not married. He acknowledges having had rheumatism for three or four years prior to the attack of paralysis in 1873, but he insists that it was mostly in his shoulders, back, feet, and hands. He was frequently unable to open his hands on account of the "cramps." At my request Dr. Piffard presented this case for diagnosis to the N. Y. Dermatological Society, at a meeting held November 25, 1879.[1] But very little personal history could be obtained, and the only lesions present were *multiple cicatrices.* The diagnosis of constitutional syphilis was unanimous, Drs. Keyes, Piffard, and others, pointing out the characters of the cicatricial lesions. Dr. Bulkley drew attention to the infrequency of hemiplegia under any other conditions in a man of his age.

The patient's health is now pretty fair, although he has not the full use of his right leg, and has great vertigo on sudden movement, and staggers in walking. Autophony remains as before. On being requested to sing he made a very good effort for one who never had any musical education; the singing, both to himself and others, being heard as correct in regard to tune, etc. Treatment in this case, for reasons above stated, was directed to the epileptiform and vertiginous symptoms only.

Constitutional Syphilis.—Double Facial Paralysis.—Oral Irritation.—Sudden Deafness.—Case II.—E. D., æt. 40, English, occupation that of waiter, June 5, 1879. The patient had a chancre eighteen months ago, and was subsequently treated for syphilis in Charity Hospital; three months later, after contracting a severe cold, he had paralysis of the right side of the face. Six months after the initial lesion and three months after the Bell's palsy he became suddenly deaf in both ears. He describes the invasion as follows: After much exposure to rain, etc., he went to bed with a severe cold. The next morning he was so dizzy that he could not walk, and at breakfast he found that he could only open his mouth wide enough to get a spoon between his teeth. The pains in the right side of the head were of the most severe

[1] *Vide* Archives of Dermatology, April, 1880, p. 152.

character. Not long after breakfast, while engaged in conversation with a friend, he found that his friend's lips were moving without the utterance of any sound, as he supposed; he was quite out of patience at this and asked his friend what he was whispering about. He now realized that his hearing had suddenly left him. The "lock-jaw," as he styled the inability to move his jaw, was due to the double facial paralysis that existed after the left side of the face also became paralyzed with this last attack; it was a week before he could obtain any control over this condition, but as the patient himself expressed it, it drew his jaw straight. For the seven months following this attack, pains in his head were constant and intense, "cutting like a knife." His sufferings were intense. During this severe illness he was, he says, treated by inunctions of mercury. He was greatly run down.

The patient has now been deaf for a period of one year; during this time the noises in his head have almost made him crazy. He had pains in his ears (?) and severe vertigo until a few months ago. The ears never discharged. Examination shows the existence of decided pharyngitis. The most marked condition on making an oral examination was the state of the teeth and gums; from the tartar and previous caries of the teeth the mouth had probably long been in an unhealthy state, but the active use of mercury was also thought to have increased this difficulty as no care was given to the teeth during the treatment. The breath was most foul. A vibrating tuning-fork is heard in both ears when placed on the vertex. He speaks in reply to written questions in a voice but little short of shouting. He hears his own voice in both talking and singing—he thinks in both ears—He sings simple airs correctly, they also seem correct to him. He says his head is full of noises—crowded with noises —and he has a constant feeling that there is "something that wants to come out," which he fancies would give him relief. He is indescribably anxious about his condition, and, although given a mercurial course, as he states, without benefit, yet he is sanguine that he can be assisted. The *meatus* at inner extremity are hyperæmic and probably denuded of epithelium. The drumheads are lustreless, whitish in color, and have a retracted aspect. No treatment was advised.

Constitutional Syphilis—Sudden Deafness—Oral Irritation—Better Hearing in Noise—Improvement under Treatment with Mercury and Iodide of Potassium.—Case III. (at the New York Eye and Ear Infirmary, March 11, 1880).—A. T., æt. 31, mulatto, occupation a sailor. This patient was the subject of constitutional syphilis. In 1874 he was for eight weeks an inmate of Greenwich hospital with syphilis; three months later while in Chili was in a hospital with condylomata on the anus. In 1878 he had chancroid, and a bubo which suppurated while he was in Mauritius. Finally, about nine months ago, he had another crop of "chancres" on his penis, and three months ago a bubo in the groin that has just suppurated. As he

frankly remarked at first, he has had "plenty of syphilis." For the past three or four years he has been subject to rheumatism in his knees and thighs. He thinks he never had any cutaneous eruption or sore throat. For most of the attacks of disease the patient was not under any medical treatment. The patient was not aware of deafness existing prior to this attack. Fifty days ago on coming out of the Thames river on a vessel, he was hurriedly turned out of his bunk at four o'clock in the morning and sent aloft, on account of the weather, to take in sail. When he came down on deck again he "found the chaps talking to him, but could not hear a word they said." He now began to experience very great frontal headaches and vertigo—symptoms that have continued with greater or less severity ever since. Both ears seemed to be similarly affected as regards the deafness. The right tragus was painful, and from beneath the right mastoid extending downward there was also pain (from the teeth?). He fancies that he could hear a good deal on shipboard at first, especially orders, when the wind made a great deal of noise.

Examination.—He is considerably run down, but the condition that attracts most attention after his deafness is the serious oral irritation. It appears that he had scurvy in 1869, previous to which his teeth were sound, and since that time he has had much toothache. The jaws now contain but few sound teeth, but many remain in the spongy-looking and congested gums that have been eroded away by caries, and are now but little more than unsightly fangs, loosely held in their places. There is decided pharyngitis, and he has long had naso-pharyngeal catarrh. The breath is bad. His general condition is pretty fair, considering the circumstances. He has pains in back of head, extending to neck and ears. About two weeks after the attack of deafness he syringed the ears freely every day with warm-water; this was continued for three weeks.

He cannot understand anything spoken, even when shouted. This extreme deafness has now existed for about five days. Intensely loud tones of high or low pitch are heard, and heard better when he is on the noisy streets. He hears his own voice plainly, but he describes it as having a "rumbling" quality, and it "seems as if he was talking hoarse." On being requested to sing, he sang correctly, "The sea is bright;" it was "in tune" to him also, but sounded as a voice at a distance. Tissue conduction exists for the vibrating tuning-fork when placed on the skull, as well as for his own voice. Highest and lowest sounds are heard as high and low when shouted close to the left ear; they are not thus distinguishable when shouted into the right ear.

For several weeks the noises in the head have been very pronounced. He describes them as "like a train of cars passing," or "the waves beating against the shore," etc. These noises vary in character, and sometimes they are absent.

The *meatus* are large, and at the inner extremity they are hyperæmic and have rather a dry and glairy appearance. The drum-heads do not look

thickened, but they have a humid aspect that seems to be imparted by the condition of the mucous coat of the membrane. Extending from the *meatus* on to the dermoid layer of both the membranes is the same moderately hyperæmic condition that characterizes the former. It gives to the drum-heads the appearance of having at their circumference a ring of hyperæmic tissue. This hyperæmia is more marked about the short processes, and it also extends down along the malleus handles. The membranes are retracted, especially the right one.

On March 12th he was admitted to the Infirmary as an in-patient, and given iodide of potassium, grs. xx., three times a day, with inunctions of blue ointment morning and evening.

March 18th.—The left membrane is found to be more humid and hyperæmic in appearance, as compared with first examination; but one portion is not more affected than another. The right membrane is hyperæmic at the superior segment, but altogether it seems to be clearing up. His gums are touched by the medicine; his breath has a bad odor and he has a bad taste in his mouth; his throat is a little sore. He can hear words shouted into the left ear. Medicine discontinued.

March 22d.—The membranes are still clearing; no hyperæmia, excepting at the anterior superior quadrant and along malleus handle of the right. His general condition improving. The gums are yet tender and the breath foul. Hearing: loud voice in the left, shouting in the right. To take the following: ℞. Hydg. bichlor., gr. ij.; kali iod., ʒ x.; aquæ, ℥ vi.; ℳ. Dose a teaspoonful three times a day.

March 25th.—For past two days the voice and street sounds have been heard more plainly; he cannot, however, distinguish words at the distance of a foot. The hearing of both ears now seems to be about equal. There is some itching of his legs; his mouth is very sore. To take the medicine twice daily. It has been decided to have some of the worst of his teeth extracted.

March 29th.—Dr. Oppenheimer, who has, as house physician, been very attentive in this interesting case, reports that five teeth have been extracted, and that his mouth is getting well. He hears loud voice in both ears at a few inches' distance, but best in right.

April 1st.—Improvement in the appearance of the drum-heads and in hearing. ℞. To take iodide of potassium only, but in increasing doses up to one drachm three times a day.

April 5th.—Has to cease taking the medicine. He has severe headache, and is constipated. His hearing is better.

April 8th.—The left membrane is comparatively translucent; the right has still a retracted look, and is not altogether free of the humid appearance. To have no medicine.

April 12th.—The mixed treatment has now been resumed. He hears loud voice quite easily in either ear at a distance of twelve inches. The mouth looks

well; his appetite is good; sleeps well. His hearing is now more variable than heretofore; sometimes he can hear ordinary voice. Treatment continued.

April 15th.—Hearing improving. The gums are spongy, the tongue clean. He is to have the mixed treatment pushed to as great an extent as possible, the potassium iodide to be increased rather than the mercury.

April 24th.—The medicine was stopped—he had an eruption on face and neck which was supposed to be due to the potassium iodide. His general condition is good; the tympanic membranes look better—his hearing has also improved; he can understand loud voice pretty well in right ear at a distance of six feet or more. He no longer has noises in his head, or vertigo. An upper incisor tooth is painful, and he has had several attacks of epistaxis.

April 29th—General health good. To resume the mixed treatment in small doses administered twice daily.

May 9th.—To discontinue treatment. The membranes are now more clear, scarcely any of the humid state remains, and they have a somewhat normal appearance. There are quite regular cones of light. He has made an application to ship for a cruise, but the captain discovered that he was deaf.

May 13th.—The patient has succeeded in getting a captain to take him, and expects to sail in a few days for Brazil. I should mention that during the latter part of treatment in this case I practised rarefaction and condensation of air in both *meatus* on several occasions: it was always followed by an improvement in hearing. This patient would probably have borne larger doses of iodide of potassium, but the drug was not pushed further for fear that injury to the kidneys might result.

There is a point of interest in connection with certain symptoms presented by this case to which particular attention may be drawn. I allude to the variable hearing and the better hearing in noise. These phenomena probably depend on a relaxed state of the membranes and anomalies of the articular surfaces of the ossicula.

REMARKS.

As regards the pathology of this syphilitic invasion of the ear, it may be surmised that granuloma, or circumscribed, small round-cell infiltration, takes place within the tympanum—that the invasion is rapid, and that the conductive apparatus is prevented performing its movements by the particular manner of fixation that occurs. It is doubtful if our present means of pathological study could definitely determine its precise seat in all cases.

In cases II. and III. the oral and pharyngeal symptoms are

worthy of note as showing the probable existence of hyperæmia of the drums, from reflex sympathy previous to the syphilitic invasion.

Treatment of a specific nature was only adopted by me in one of these cases: in case I. the character of the lesion was not suspected. In case II. mercurial and perhaps mixed treatment had been carried out extensively without avail. In case III. the patient was seen at a comparatively early period of the invasion, and the beneficial results were quite marked. Referring to such cases Dr. Bumstead says: "When seen early very large doses of the iodide of potassium internally, and the use of mercurial inunction, give some promise of relief and perhaps cure, and even at a later period the patient should have the benefit of a trial of these remedies."

MEETINGS OF SOCIETIES.

Thirteenth Annual Meeting of the American Otological Society, July 21, 1880.—This society met at Newport, R. I., on the above date. In the absence of the President and Vice-President, Dr. J. Orne Green, of Boston, was chosen as temporary chairman.

There were sixteen members present. Six new members were elected on the recommendation of the Committee on Membership, and Prof. A. Graham Bell, of Cambridge, Mass., was elected Honorary Member.

The names of six candidates for membership were proposed to the Society and referred to the Committee on Membership.

Four members, who had announced papers for this meeting, were unavoidably absent.

The following papers were read: *A Case of Aneurism of the Middle Meningeal Artery from Traumatism*, by Dr. H. N. Spencer, of St. Louis. A man, twenty-six years old, was fired upon with buckshot at the left side of the head. Falling from his horse he lay on the wet ground for one or two hours. Three or four days after the injury he perceived a feeble noise in the left ear, but hearing was, according to the patient's statement, not im-

paired until from three to five weeks after the injury, and this defect gradually increased, until at the time of his coming under the care of Dr. Spencer it had attained a high degree. The paper contained arguments to refute a diagnosis of traumatism of the labyrinth, which had been made, and in favor of chronic catarrhal inflammation of the middle ear, caused by the exposure and complicated by the injury, and of aneurism of the middle meningeal artery.

The discussion on this paper, in which Drs. Kipp, Agnew, and J. O. Green took part, was especially in regard to the diagnosis of aneurism.

Dr. J. O. Green, of Boston, Mass., read a paper on *Osteo-Sclerosis of the Mastoid*, with a specimen. The patient had total deafness on both sides. Some months before admission to the hospital there had been otorrhœa on the left side with severe pain in the left ear and mastoid, followed by an abscess just below the mastoid, which had been opened. This was followed by complete paralysis of all branches of the seventh nerve on that side. The otorrhœa and abscess healed, but the ear remained deaf and also the facial paralysis persisted. Six weeks before admission to hospital, otorrhœa in right ear, followed by total deafness. On examination at time of admission a countenance suggestive of syphilis was noticed, but no other symptoms of that disease could be detected. Both ears totally deaf; left facial paralysis; otorrhœa in right ear, with pain in the ear and right side of scalp; dizziness. Left membrana tympani had been destroyed and replaced by a plane cicatricial tissue, adherent to the inner wall. Right membrana tympani largely perforated. Both temporal bones apparently enlarged, their outlines being very evident and slightly raised, especially on the right side. Potass. iodid. and morphine subcutaneously. No relief. A little over five weeks after admission the mastoid was trephined and found entirely sclerosed. The pain was much relieved and gradually subsided, so that the day for her discharge from the hospital was fixed. The day before, however, she died, having been noticed to breathe heavily of a sudden, this symptom being followed in a very short time by unconsciousness. The autopsy showed numerous syphilitic growths upon the meninges; these was apparently universal hypertrophy of the bony walls of the

cavum tympani. The mastoid was entirely sclerosed. The right membrana tympani showed a large perforation in its anterior segment, which was closed by a new membranous growth, starting within the tympanic ring, and stretched across to the inner surface of the drum-membrane.

Drs. Matthewson, Knapp, Agnew, Spencer, Sexton, and Pomeroy, took part in the discussion, reporting cases, or speaking of the instruments used. In the latter respect the drill seemed to be most favored. A part of the discussion related to the relief experienced in cases like the one reported, where relief from pain followed the operation, without entering a cavity, and the probable influence of the anæsthetic in producing this relief.

The next paper was by Dr. C. J. Kipp, of Newark, N. J., *On the Ear Affections of Inherited Syphilis.* Six cases were reported. In five of these keratitis had existed in both eyes before the ears were affected; in one case the keratitis followed the ear disease. Loss of hearing mostly sudden in both ears, tinnitus, dizziness, and staggering.

Similar cases were reported by Drs. E. Williams and John Green. The further discussion, in which Drs. Knapp, Agnew, and Sexton took part, related to different modes of treatment and to the possibility of cerebral origin of the deafness, as it is almost universally bilateral. Dr. Knapp pointed to the fact that, after cerebro-spinal meningitis, although one-sided blindness is common, one-sided deafness does not occur, and that in injury to the skull both petrous bones often show exactly the same lesion. From this he argues that there is a closer and more intimate connection between the two ears than between the two eyes.

Dr. C. J. Kipp also read a paper on *Branchial Fistulæ at the External Ear.* He has observed six cases, in three of which the fistulæ were connected with retention cysts.

Dr. Sexton, during the discussion, showed two photographs, bearing upon the same subject, one with rudimentary auricle, the other with defective cartilage formations, so that the auricle had the appearance of a rose-bud, which, on being unfolded, exhibited a normal appearance, but showed at the same time an imperfectly closed branchial fissure.

Dr. Knapp read a paper entitled *Some Remarks and Observations on Bone Conduction.* He thinks that bone conduction can give only quantitative sound, and perhaps pitch, just as quantitative light perception takes place with closed eyelids, or closed pupil, but that for qualitative perception, melody, harmony, and articulate speech, the participation of the conductive apparatus is needed, just as the refracting apparatus of the eye alone can give clear perception of objects, that is qualitative light perception. This opinion is based upon the analogy between the organs of visions and hearing; experiments with the watch, which is never heard at the mastoid when it is not heard on contact with the meatus; the audiphone, which does not increase the hearing, according to his experience, any more, and often less than the ear-trumpet, and the results of Politzer's inflation or paracentesis.

The paper was discussed by Drs. Blake, Pomeroy, and Andrews.

VERBAL COMMUNICATIONS.—EXHIBITION OF SPECIMENS.

1. *Phlebitis of Lateral Sinus and Emissary Mastoid Vein*, by Dr. J. O. Green, Boston. The case was reported in the *Amer. Journ. of Otology*, II., 2.

2. *Necrosis of the Inner Table of the Mastoid*, by Dr. J. O. Green, Boston. Case reported in *Boston Medical and Surgical Journal.*

3. *Pieces of an Osseous Labyrinth, Exfoliated from the Ear of a Patient seventy years old*, with short history of the case, by Dr. C. J. Blake, Boston, Mass.

4. *Exostoses in the Ear Canals of the Mound-Builders*, by Dr. C. J. Blake, Boston, Mass.

Dr. Blake had examined 125 skulls of the Mound Builders of Tennessee, and 200 of California Indians, after contact with the whites. This latter examination was especially in regard to the existence of syphilis. Exostoses were found in forty-seven cases.

EXHIBITION OF INSTRUMENTS.

1. *Modification of Politzer's Air-Bag*, by Dr. J. O. Green, Boston. A folding-bag, made of rubber cloth, easily compressible and more portable than the ordinary bag.

2. *Instrument for the Removal of Epithelial Masses from the Meatus and Cavum Tympani*, by Dr. E. D. Spear, Jr., Boston, Mass., presented by Dr. Blake, of Boston. A finely toothed curved forceps, resembling somewhat the fixation forceps for the eyeball.

3. *Aural Syringe*, by Dr. O. D. Pomeroy, New York, N. Y. Toynbee's syringe, with a long, thin nozzle, to be introduced deep in the meatus, near the object to be removed, and with a protective flange at upper end of the nozzle.

4. *Drop-Tube and Powder-Blower*, by Dr. J. A. Andrews, Clifton, Staten Island, N. Y. Two instruments for the application of fluid or pulverized medicine to the tympanic cavity, through perforated membrana tympani.

Dr. J. Green, St. Louis, Mo., offered some remarks about the use of common salt as cleansing solution in otitis media purulenta, with perforations of membrana tympani.

The following officers were elected: *President*, Dr. J. Orne Green; *Vice-President*, Dr. J. S. Prout; *Secretary and Treasurer*, Dr. J. J. B. Vermyne; *Committee on Publications*, Drs. J. J. B. Vermyne, C. J. Blake, and J. O. Green; *Committee on Membership*, Drs. C. J. Blake, O. D. Pomeroy, and John Green.

The next annual meeting will occur on the day before the annual meeting of the American Ophthalmological Society and at the same place.

Meeting of the Subsection of Otology of the British Medical Association.—This took place in Cambridge on August 11, 1880 (*The British Med. Jour.*, Sept. 4, 1880). The opening address was delivered by the chairman, Mr. Dalby.

Mr. Woakes read a paper on the diagnostic and therapeutic value of electricity in ear disease. Alluding to the property of the electric current of inducing dilatation of vessels, and, therefore, of adding to congestive states of the auditory apparatus, the author thought that, as a remedy in ear disease, its usefulness as a curative agent was essentially limited.

The paper was discussed by several gentlemen who had had more or less experience in the use of this agent; the conclusion at which the meeting arrived was " that electricity might be expected

to be useful in ear diseases in proportion to the necessity which existed for increasing muscular power in some portion of the conductive apparatus, but that up to the present, experience pointed to the fact that it was an open question whether in such cases the results of electric treatment were permanent."

The subject of hearing best in noise—*paracusis willisii*—was discussed in a paper by Dr. Loewenberg (Paris), who took the view that in cases of deafness, where the patient heard best in noise, there was want of vitality in the auditory nerve; that the sensibility in these cases is increased by the excitation of noises, thus enabling the patient to perceive vibrations he would not perceive under ordinary circumstances. This view, in the discussion that followed, does not seem to have been very much opposed, but, on the contrary, it met with the complete endorsement of the chairman, Mr. Dalby. Mr. A. Gardner Brown presented to the meeting his *new standard of measurement for hearing-power by comparison with the sense of touch.* This method consists in a comparison of the sensibility of the patient's auditory nerve with the sense of touch of the examiner—the latter being able to feel the tuning-fork's vibrations by the sense of touch for some time after the patient has signified that he has ceased to hear them. The practical value of this method was not considered to be very great by those engaged in the discussion, although the chairman himself had no doubt that it would be largely used. Mr. Baber, of Brighton, thought the sense of touch might vary with different surgeons; also, that some patients might be more or less prompt in indicating the exact moment in which they cease to hear the sound of the tuning-fork.

Mr. F. M. Pierce, of Manchester, described a case of *Lupoid eczema of the external auditory meatus*, which got well under his treatment in the course of a year; this consisted of incision of the parts; the local application of zinc and alum lotion, perchloride of iron, nitrate of silver, tincture of iodine, chromic acid, Valette's lotion, lotion of acetate of lead, ointment of iodide of potassium, laminaria tents, liquor carbonis detergens; and the internal administration of strychnia with iron, bichloride of mercury, liquor arsenicalis with iodide of potassium, and Donovan's mixture. Mr.

Pierce also reported *a new method of treating the later stages of chronic suppuration of the middle ear.* His method consists of carrying down into the meatus cotton-wool plugs that have been medicated. Dr. Pierce was unable to find any mention of this plan of treatment in the writings of authorities on the ear. [The New York *Med. Record* contained, several years ago, a paper on this subject, recommending the use of medicated cotton-wool in the treatment of suppurative affections of the middle ear.]

In discussing this paper Mr. Pinder (Manchester) said that benefit could not be expected until the tympanum was cleared of granulations or the mucous membrane brought into a healthy state through an enlarged opening.

On Thursday, August 12th, the second day's proceedings of the subsection began with a *discussion on the comparative value of the various mechanical aids to hearing.* The subject was opened by Dr. Urban Pritchard, of London, and was participated in by Messrs. Baber (Brighton), Eglin (Glasgow), Cassels, Pierce, Loewenberg, Woakes, Brown, Abbott, and the chairman; the facts elicited in no wise varied from what has been arrived at on this side of the Atlantic; the chairman, Mr. Dalby, said "that this discussion tended to the conclusion that the audiphone was only useful for incurable cases of disease of the middle ear or closure of the external canal. In both classes of cases it was absolutely necessary that the nervous structures should be unimpaired. The best forms of artificial membrane would be those by which pressure could be exerted by the patient on the stapes at the same time that the tympanic cavity was protected from the air, and the discharge absorbed. No special form could be recommended as likely to be universally useful."

The third sitting of this subsection took place on Friday, August 11th. In the enforced absence of Mr. Dalby, the chair was taken by Dr. Loewenberg, of Paris, at 11.30 A.M.

Dr. Cassells gave an address on *antiseptic aural surgery,* in which he related his experience in search of an efficient antiseptic agent in the treatment of otitis media purulenta. The plan he has finally adopted is as follows: first cleanse the ear as thoroughly as possible, using absorbent cotton-wool for that purpose, with as lit-

tle syringing as possible, better none at all; the meatus is then to be packed with boracic acid, reduced to an impalpable power. This should not be disturbed until stained by the discharge. In the discussion of this paper, various modifications of the method were suggested. Dr. Cassells stated that he used boracic acid in case of mastoid abscess with good results; they generally healed up after the second dressing, and without putrefaction. Dr. Cassells had almost entirely given up using alcohol in these cases in favor of boracic acid. He had not prescribed a single lotion of alcohol in the Glasgow Hospital for diseases of the ear for the last six months. Dr. Pritchard did not regard this as a scientific antiseptic treatment, such as Professor Lister carried out, because the germ of disease might possibly be introduced through the Eustachian tube, while Lister's method implied a perfect closing up of the parts antiseptically treated. There was some doubt expressed by others as to the propriety of designating this treatment as antiseptic. Dr. Cassells said that he never compared his antiseptic treatment of ear diseases with that of Lister; besides, long before the method of Lister came into practice, the word antiseptic was known and used to denote an antiputrefactive agent. His results showed that ear diseases could be treated antiseptically.

The Secretaryship of the Subsection was, before adjournment, taken up, inasmuch as Dr. Cassells wished to resign after having held the position for two years. He had organized the first meeting of otologists ever held in Great Britain last year at Cork, and also the present meeting at Cambridge, and he found that he could not undertake the duties again. His efforts had shown that successful otological meetings could be got up at these yearly meetings of the Association. Dr. Cassells thought that otology ought to be a section by itself at the next meeting of the Association, as it would be at the International Medical Congress to be held in London next year, when Mr. Dalby would be president, Dr. Fitzgerald and himself, vice-presidents, and Drs. Pritchard and Purves, honorary secretaries.

Messrs. Hemming and Baber were recommended unanimously for the joint secretaryship of the next meeting.

BOOK NOTICES.

Lehrbuch der Ohrenheilkunde, von Dr. Victor Urbantschitsch. Wien: 1880. 568 pp., 75 woodcuts and 8 plates.

Somewhat later than ophthalmology, yet following closely in its footsteps the study of otology has made rapid advances during the last few years. The valuable investigations in anatomy, especially of the internal ear, and in physiological acoustics, the numerous contributions to pathology and therapeutics, gave birth to two new journals, the *Annales des maladies de l'oreille et du larynx*, and the American Journal of Otology, and necessitated the separation of the *Archives of Ophthalmology and Otology* into two separate parts. With this increase in journalistic literature came also a number of handbooks or treatises on diseases of the ear. When men like Roosa and Burnett in this country, Gruber, Von Tröltsch. and Politzer, in Germany, publish in a complete form the results of their investigations, and of their practical experience, no one will think that the works of these masters are unnecessary. Another handbook has recently appeared from the pen of Dr. Urbantschitsch, of Vienna. From a number of valuable contributions to otological literature, the name of this otologist is so well known as that of a careful observer, that this work will certainly be welcomed by all students of otology.

The subject-matter of the book is thus divided: the first 81 pages form the introduction, which contains the description of the methods of examination of the organ of hearing and the general treatment of its diseases. The special part of the book is divided into seven chapters: I. Auricula; II. Meatus Auditorius Externus; III. Membrana Tympani; IV. Tuba Eustachii; V. Cavum Tympani; VI. Pars Mastoidea; VII. Labyrinth and Nervus Acusticus. The cavum nasale and naso-pharyngeale are treated as an appendix to Chapter IV. The last twenty pages contain observations in regard to ear diseases from a medico-legal point of view and also in regard to life insurance.

Introduction.—I. The examination of the organ of hearing; treats of the different methods of, and instruments for examination of the external, middle, and inner ear, the functional examination and that of the general condition of the patient. Like Politzer, Urbantschitsch advises the correction of the re-

fraction of a hyperopic eye in the use of the mirror. On page 5 is found a careful statement of the different points to be considered in examining the external ear and membrana tympani, the latter especially in regard to position, form, size, thickness, inclination, curvature, color, reflex, and mobility.

The examination of permeability of the tuba Eustachii is made by means of Valsalva's experiment, by catheterization and by Politzer's method of inflation. The first is condemned as a therapeutic agent, because it occasions congestion of the head, whereby existing hyperæmic conditions may be increased, and because the patient may push the experiment to excess, thereby inducing distention and flabbiness of the membrana tympani. The author does not approve of the use of long catheters, sometimes recommended, especially in the hands of beginners. In some cases, in inexperienced hands, for patients who purchase their own catheters, or when injections through the catheter must be made which can chemically affect the instrument, he uses the hard rubber; in every other case by preference the metallic catheter, as having the advantage of allowing a thorough cleansing by boiling, more thorough than by different disinfectants. The different methods followed by Boyer, Kramer, Politzer, Triquet, Wolff, and Löwenberg, are mentioned, with the accidents which catheterization may occasion, also the methods of Pomeroy and Kessel, reviving the original method of the inventor of the catheter, through the mouth, and the catheterization through the opposite side of the nose, proposed by Deleau. The catheters devised for this purpose by H. D. Noyes, and described in the Transactions of the American Otological Society, III., 81, are not mentioned.

Page 23 contains some very good advice in cases where the catheter becomes fixed from extensive swelling of the mucous membrane, tumors, etc.; or when the patients are very sensitive or have become so from repeated unsuccessful attempts at catheterization, the vomiting or spasmodic attempts at swallowing usually tending to fix the catheter more firmly yet. Keep the catheter immovable and tell the patient to take a deep breath, and when quiet is restored, withdraw the catheter or insert it rightly. As an active means in this direction, though, as he observes, hardly practicable in private practice, accosting the patient in a loud and angry tone of voice may cause relaxation from sudden fright, enough to make a rapid removal of the catheter possible.

He warns against inflation after introducing bougies into the tube, on account of the danger of emphysema, which is likely to follow, and the experience of Voltolini, reported in *Monatss. f. Ohrenh.*, XIV., No. 5, will certainly tend to give additional force to this warning.—He is much in favor of Gruber's method of using phonation of "hck" during inflation in place of swallowing, and calls attention to the difference, which may sometimes be found in inflation from the left or right nostril, as explained by some tables of manometric experiments.

In comparing the value of Politzer's method with that of catheterization, the opinion is given that the catheter deserves a more extensive use. Several indications are given for the use of catheter and of Politzer's method, and in regard to the latter it is said that since the introduction of this method a rational treatment of ear disease in children has become possible.

Page 36 mentions the proposition of von Tröltsch, to examine the tympanic cavity through a perforated membrana tympani, by means of small metallic mirrors, and that Eysell has constructed mirrors for this purpose. In the Transactions of the American Otological Society for 1872, Blake described a middle ear mirror, which is also mentioned in the works of Roosa and Burnett, but which is not spoken of in this book.

Page 39. A description is given of the examination of the n. acusticus in regard to its reaction to sound and the galvanic current, and for localization of a disease of this nerve. The functional examination takes place by watch, tuning-fork, and the voice. Politzer's acoumeter is only mentioned in a short note. The rules for the examination are those in general use: but he calls attention to the fact that the examination with the tuning-fork may give different results for different parts of the day, without any corresponding change in the condition of the ear itself; that the perception of the sound of a tuning-fork applied to the cranium may differ very much with the place of application, even so far as to produce a crossed perception, and that after sixty years of age cranial perception frequently fails in persons in whom the air-conduction is still intact.

On page 51 is given the method of general examination, where the following points merit notice: the occupation of the patient and the great influence of heredity, constitutional diseases, affections of the central nervous system, the heart and large blood-vessels, the nasal cavity and other organs of respiration; and a schema for recording cases on pages 53 and 54, completes the first part of the Introduction.

The second part of the Introduction contains general therapeutics. Here we find the rules for dietetics, application of cold, and syringing of the ear. Two cases are mentioned, one of Schwartze and one his own, where severe dizziness followed the syringing. In Schwartze's case section showed a patent foramen ovale; in his own case the patient did not recover her health for several months, and with much justice he makes the observation that syringing the ear is not always a harmless proceeding. Yet how often it is resorted to by patients, or even advised by physicians, when the most careful examination fails to show any rational necessity for this treatment! The chapter further treats of injections into the Eustachian tube, medicated ear-baths, gelatine preparations, powders, and general caustic treatment, by chemical agents or by the galvano-caustic. Several instruments are described and illustrated. In speaking of the paracentesis of the membrana tympani, he makes the remark that beginners often experience some difficulty in judging exactly

of the distance of the point of the instrument from the membrane, and, for practice, he advises the use of a funnel-shaped speculum, the end of which is cut off obliquely from above downward, so as to correspond with the inclination of the membrana tympani, and to close this end with a paper disk, on which some points have been marked. By using the reflected light from a head-mirror, the student can exercise himself not only in judging of the distances, but also of the depth to which the instrument must penetrate in making a downward incision, where it is necessary to follow the inclination of the membrane. In speaking of artificial membranæ tympani, mention is made of the paper disc recommended by Blake. While it is undeniable that the disc in question acts as an artificial membrana tympani, yet the idea of the proposer was more that of a therapeutic agent in closing up small perforations, for which purpose they have proved very successful in his hands and in those of several others.

Among the different forms of tenotome for tenotomy of the m. tensor tympani, we do not find any mention of Orne Green's modification of Gruber's tenotome, which was also used by Pomeroy. (Transact. Amer. Otol. Society, 1873–1874.

Page 68 the statement is made that Von Tröltsch had proposed the use of a Pravaz syringe for injections in the tympanum, through a perforated membrana tympani. A little more than five years ago Blake constructed a middle ear syringe, which the reviewer has used also about four years. The instrument was never described by Blake, except in the first number of the second volume of this journal, but it was shown to the members of the American Otological Society at the meeting of 1878.

For the removal of secretions from the nasal and naso-pharyngeal cavity Weber's douche is recommended, with the precautions necessary to prevent injury to the middle ear as mentioned by other authors in regard to the height of the vessel, temperature, avoidance of swallowing, etc. Gruber's method, whereby fluids are pushed up into the cavum tympani through the tubes, is spoken of as dangerous, unless both membranæ tympani be perforated. The use of alum for throat-baths is condemned, as the sulphuric acid in its composition chemically affects the teeth and thereby causes caries. On page 76 some excellent advice is given in regard to the disinfection of instruments.

Page 78 treats of the artificial aids to hearing, ear-trumpets, etc., and on page 79 are found the rules for anatomical examination (methods of Von Tröltsch, Wendt, and Schalle, for removal of the entire organ of hearing), and that of the separate parts.

The special part of the work begins with a division of the organ of hearing into the external, middle, and internal ear. The membrana tympani cannot be considered as belonging either to the external or the middle ear, but belongs genetically to both, and is treated separately. The internal ear is called the organ for perception of sound and for equilibrium (Schallpercipirendes und

"statisches" Organ). As was already stated, this part is divided into seven chapters, each of which is subdivided into two parts. The first part contains the morphology, anatomy, aud physiology, the second part the pathology and therapeutics. One general plan is followed in regard to the subdivision of these chapters. In regard to the anatomical descriptions it can be generally said, that they are as short as possible and often require the study of the accompanying illustrations for some of the anatomical details.

Chapter I. *Auricula.*—No original idea is given in regard to the function of the auricule. The opinions of Rinne, Savart, and Mach are given, respecting its office as a conductor of sounds, condenser of sounds, or as a resonator for the higher tones. Burnett's investigations, which prove that by the superposition of the auricula upon the meatus externus the ear is enabled to analyze composite sounds, are not spoken of.

As spontaneous othæmatoma he describes a condition dependent upon changes in the cartilage, especially found in older people, and sometimes in younger patients, when tuberculosis exists. The cartilage becomes fissured and forms cavities filled with mucoid masses, large capillary blood-vessels and vascular connective tissue appear in the cartilage, whereby a predisposition to othæmatoma is created. The othæmatoma of the insane is not considered as depending exclusively upon a symptomatic anomaly of tissue occasioned by the disturbance of the nervous system, but is believed to be due in great measure to traumatism as well, because it occurs mostly at the left side, the side most exposed to blows. Here the author is somewhat at variance with Brown Séquard, who produced this form of tumor artificially, simply by irritation of the corpus restiforme, the tumor forming on the corresponding side, and who makes the observation that, in the insane, these tumors usually occur at the affected side of the brain, so that they cannot always be considered as due to violence on the part of the patient or his attendants.

As the most successful treatment for angioma electrolysis is recommended.

Chapter II. *Meatus auditorius externus.*—Like Hunt and Moldenhauer, Urbantschitsch denies the formation of this canal from the first branchial cleft, a return to the older views of Autenrieth and v. Baer. In the embryo the canal is filled with an epithelial mass, which disappears first at the entrance of the meatus and at the membrana tympani, and from these two points the forming of the lumen of the canal gradually takes place, so that at one time this lumen is represented by two truncated cones, the bases of which are the entrance to the meatus and the membrana tympani, while the union of the tops corresponds with the place of junction of the cartilaginous and osseous parts. A considerable narrowing of the bony canal is sometimes caused by a deep fossa glenoidalis. In occlusion of the meatus, operation should only be performed, when from examination it becomes evident that the function of hearing does exist on the affected side, and the place and direction should be determined by a careful examination of the fellow ear, rather than by external indications of the

affected side. Aural fistula congenita is a remnant of the first branchial cleft. and as this cleft has no part in the formation of the meatus (see above). no communication exists between this fistula and the external or middle ear. The milky and sometimes purulent discharge which oozes out of the fistula is a secretion from its walls and not a product from the cavum tympani. The word "Kiemenfistel." branchial fistula, at the end of page 105. is evidently a mistake and should read "Kiemenspalte," branchial cleft. From the relation of the auricle and the entrance of the meatus in different animals at the time of birth. the opinion is given that a membranous closure of the meatus is not formed by real cutis. but by epithelial tissue. Anomalies of secretion are very extensively treated; we fail. however. to find any mention of the function of cerumen, and among causes of impacted cerumen might be classed the efforts of persons to cleanse the ear by some contrivances (aurilaves, etc.). by which the cerumen, in place of being removed. is more often pushed deeper into the meatus. In otitis externa circumscripta the pain is not always greatest at the diseased spot. but is sometimes referred to the teeth or other parts of the head, especially in the tuber parietale. This disease can appear sympathetically. as he has frequently observed. three to five days after the primary inflammation. a similar affection of the fellow ear on corresponding places. Although it is not stated, we presume that the author has in view only such cases where the otitis externa circumscripta depends upon outside causes. as injury. The diagnosis of this disease contains differential diagnosis between otitis externa and atheroma, protuberance of the upper wall of the meatus. exostoses. polypi and growths, or abscesses which penetrate into the meatus from the outside, as for instance, through the incisuræ Santorini. Syphilitic and diphtheritic processes can cause a narrowing of the canal. diphtheritic ulcers often an extensive gangrene of the external ear and adjacent parts. In regard to exostoses in the external meatus. Urbantschitsch quotes Seeligman, who found in the American prehistoric crania exostoses quite frequently. while this frequency was denied by Welcher. In the second number of this volume of the *American Journal of Otology*. Blake has communicated the result of the examination of 275 crania of mound-builders, in eighteen per cent. of which exostoses were found to exist. Most of these crania were brachycephalic. which excludes the idea that compression of the head might be one of the causes of these growths. Of great interest are the pages devoted to anomalies of contents of the meatus. comprising epithelial masses, parasites. insects (muscida lucilia and sarcophaga). and foreign bodies, vegetable or mineral. although there is nothing new; some interesting cases from his own practice and that of others have been shortly mentioned.

CHAPTER III. *Membrana tympani.*—The membrana tympani is formed, according to the author, from the ectoderm and mesoderm. Moldenhauer and Rauber, on the other hand, derive its origin from all three embryonic layers. This difference of opinion results from a disagreement as to the loca-

tion of the origin of the tube. Urbantschitsch derives it from the oro-naso-pharyngeal cavity, in the formation of which, of course, the inner blastodermic layer takes no part. Moldenhauer and Rauber consider that it originates from the alimentary tube, and as the hypoblast lines this tube, all the embryonic layers, as above stated, are involved in the formation. The foramen Rivini is considered pathological like any other opening to be found in the membrana tympani, and reduplication of this membrane is regarded as simple membranous new-formation. In regard to the first it must be stated that the name of foramen Rivini does not appear, it is only spoken of as congenital perforation in the upper part of the membrana tympani, hitherto considered as depending upon defective development. The appearance of the membrana tympani in normal and pathological conditions, adhesion, the relation of the ossicles and their appearance to ocular inspection, as also increased convexity and concavity are treated very exhaustively. The dizziness often occurring in perforations is ascribed to difference of temperature. On account of the retractive power of the fibres of the membrane, quadrangular bodies may produce a round opening, and originally linear wounds may assume the shape of gaping, round perforations. Large perforations of the membrana tympani can cause an entire change in the position of the manubrium mallei, which is drawn inward by contractions of the m. tensor tympani, so as to become almost invisible. If, notwithstanding almost total perforation, the manubrium retains its place, it indicates either a pathological condition of the m. tensor tympani, or anchylosis of the malleo-incudal joint, or calcareous deposits with immobility of the remnants of the membrane. A condition similar to the arcus senilis in the cornea can be found in the membrana tympani. The chapters on hyperæmia and hæmorrhage, and on myringitis, are well written.

Chapter IV.—*Tuba Eustachii.*—It was already stated, while speaking of the membrana tympani, that the Eustachian tube, according to Urbantschitsch, is derived from the naso-oro-pharyngeal cavity, that is, from the ectoderm. From a series of transverse sections, from the ostium pharyngeum to the isthmus, it is stated that the lateral cartilage is very small or entirely wanting at the ostium pharyngeum, and increases upward, while it forms almost a right angle with the medial cartilage. These same transverse sections also confirmed the statements of Haller and Zuckerkandl that the tuba often consists of several pieces, joined by connective tissue and fissures of the cartilage, in which the outer integument of the tuba penetrates, as described by Henle, are so common, that Urbantschitsch considers it the normal condition. The difference found among several writers, in regard to the structure of the cartilage, is explained on the ground of alterations, which increasing age gradually occasions. The m. tensor veli, after curving round the hamulus pterygoideus, does not terminate in a spindle-shaped tendon, as is usually described, but in a broad tendon. The opening of the tubæ occurs by the contraction of this muscle, whereby the lateral cartilage and the membranous tube are lifted from

the medial cartilage; this action of the muscles is greatly assisted by the fibrous tissue which runs from the membranous tube to the aponeurotic extension of the m. tensor veli, with which it intimately connects. Sometimes this tissue appears as a strong ligament. The m. tensor veli often connects with the tensor tympani. In regard to the physiological function of the tube the views are given of Politzer, Lucae, Schwartze, Hartmann, Voltolini, and Zaufal.

Treatment by inflation or by bougies. In the use of the latter, care must be taken with bougies which are liable to swell, as such swelling may take place above and below the stenosis, and prevent the removal withont injury. The advice is given to move the bougies frequently up and down. Abnormal patency of the tubæ occurs with the atrophic form of chronic naso-pharyngeal catarrh. Antophony and the free passing of air, even with common respiration, are the chief symptoms.

As an appeudix to this chapter comes the description of the cavum nasale and naso-pharyngeale and their diseases. The influence of cleft palate upon the acuity of hearing is referred to a disturbed action of the palato-pharyngeal muscles, which cause a collapse of the tube. For the chronic catarrh different remedies and galvano-caustic are prescribed, but especially the donche, of which the statement is made that a persistent application of the naso-pharyngeal douche, with the necessary precautions, can cure very stubborn cases. Against insufficiency of the muscles of the throat, electricity or throat baths. For the removal of polypi, galvano-caustic, or the snare are considered superior to the forceps. In the application of the snare the rhinoscope or Zaufal's speculum can render great assistance.

Chapter V.—*Cavum tympani.*—As could be expected, the cavum tympani and its diseases form a large part, nearly one-third, of the whole work. It would be next to impossible to do justice, in the short abstracts of a review, to the completeness which is to be fouud in every subdivision of this interesting chapter. We shall only note a few points, especially such as contain original ideas or the results of his own investigations. The semi-canalis tensoris tympani is called a half-canal, rarely a canal, as it is considered by most of the later writers. The lower wall of the cavum tympani is sometimes pressed upward considerably by greater development of the fossa jugularis. The malleus and incus are developed from one common origin, the differentiation and forming of the articulation occur subsequently. The chorda tympani is derived from the n. facialis. Contraction of the tubal muscles influences the m. tensor tympani, as can be proved by simple movements of the head, especially lateral inclination.

As hemorrhage from the tympanum, with rupture of the membrane, is described, a condition corresponding with Roosa's otitis hemorrhagica, and a little further on we find the name of tympanitis hemorrhagica for the same

condition. The inflammation of the tympanic cavity is divided into superficial and deep or phlegmonous inflammation. Both are again subdivided into three forms, simple catarrhal, croupous and desquamative inflammations for the former, and simple phlegmonous, purulent phlegmonous, and diphtheritic inflammations for the latter. The term tympanitis is given in preference to that generally used of otitis media, as this term is too general, and the inflammatory processes in the cells of the mastoid or in the tubæ, following or accompanying inflammation of the tympanum, often possess an entirely different character. A comparison follows of this system of division with those of von Troltsch, Moos, Gruber, Schwartze, and Politzer. The most frequent cause is primary or secondary disease of the cavum naso-pharyngeale. It is mostly a direct extension of the inflammation ex contiguo, but a great influence is also exerted by the vascular communication between the cavum tympani and the cavum naso-pharyngeale, and by the relation between the m. tensor veli and m. tensor tympani. In speaking of the process of ventilation of the tympanum through the Eustachian tube, and the changes which are generally mentioned as occurring in narrowing or closing of the tube, he observes that no notice is taken of a very important factor, namely, that doubtless the membrana tympani is permeable to air, for a complete absence of air is rare, even in entire closure of the tuba. It is true that the air supply through this channel is not so rapid as to counteract the resorption of the air contained within the cavity through the blood-vessels, and the air, in passing through the membrane, undergoes a friction, so that in complete closure of the tube the air pressure within the cavum tympani is equal to the atmospheric pressure, less the resistance offered by the membrana tympani to the endosmotic air current. In a temporary occlusion of the tuba, during an acute attack of naso-pharyngeal catarrh, a sudden improvement in the hearing occurs quite frequently. In such cases, according to Urbantschitsch, the re-establishment of a normally patent tube increases the quantity of air within the cavum tympani with a part equal to that lost by the resistance of the endosmotic current in its passage through the membrana tympani.

Subjective symptoms, noises, etc., depend upon irritation of the n. cochlearis, or they are really existing noises, like muscle tone or vascular bruit, which are not observed in a normal condition. They can also be caused by movements of the secretions, or by the separation of mucous membrane surfaces which were temporarily in apposition. The excitation of the n. cochlearis depends upon hyperæmia, originating from the cavum tympani, or from increased intra-auricular pressure, and this pressure can again depend either upon a deeper entering of the stapes-plate in the vestibulum or upon the mechanical influence of the secretions within the cavum tympani upon the stapes plate and the foramen rotundum.

As dizziness is a common symptom in many ear diseases, he advises the examination of the ears in all patients who complain of dizziness.

The treatment of acute catarrh of the cavum tympani is according to the usual rules. Blake has lately treated a number of these cases by acupuncture, and drainage of the meatus, in place of paracentesis of the membrana tympani.

Great stress is laid upon the diagnostic value of the functional examination in cases of chronic catarrh, as sometimes in advanced cases no abnormal appearance of the membrana tympani can be found. Eight very instructive plates at the end of the work demonstrate the oscillations of the hearing power in cases of chronic catarrh during treatment. From these curves the following deductions are made:

1. In bilateral catarrh of the tympanum the diminished acuity of hearing can be equally improved by treatment, so that the ear which hears best before treatment also is the best after treatment.

2. It can, however, occur, that with different hearing power in both ears the ear which had the least acuity experiences the most improvement, so that there is but little or no difference between both ears after treatment.

3. The ear which had less sound perception before treatment can be so much improved that its hearing power becomes considerably greater than that of the other side, although both ears were equally treated.

4. A rapid ascent in the hearing curve in the beginning of treatment is a favorable sign, and often is permanent. But it sometimes occurs that a similar descent follows the first ascent, and that this can probably never afterward be reached again.

5. Conversely a rapid increase of the acoustic anæsthesia in the onset is not always to be regarded as an unfavorable symptom. But if, under continuous inflation, the curve continues to descend, a prolonged treatment by inflation may lead to an increase of the auricular affection.

6. Diametrically opposite changes in the curves appear sometimes as transitory symptoms. A period of four to six weeks is given for the treatment by Politzer's inflation. But the general rule for every physician, always to judge from the individual aspect of every case, must be followed, especially in regard to prolonged application of the air-douche.

Among the symptoms of chronic purulent tympanitis is mentioned disturbance of taste, which he has observed in a large number of patients. When, with existing purulent tympanitis, a cerebral abscess is found, even when the abscess is central, it should not be considered as idiopathic, but with more foundation as a consecutive abscess. Chronic purulent tympanitis can cause debility and a general diseased condition of the patient with loss of flesh, which is probably caused by absorption of the pus in the middle ear. This may also explain the practical experience that patients with chronic otorrhœa rarely attain a high age.—He has applied Bezold's treatment by pulverized boracic acid in some cases with good success, although the period elapsed since the application is too short to give a decided opinion, especially in regard to

relapse. In regard to the treatment of some cases where, especially, the roof of the tympanic cavity is affected, we would refer to what was formerly said about Blake's middle-ear syringe. Some interesting notes are given regarding expulsion of large sequesters. Recently a very grave case of this kind was reported by Gottstein, but a similar case, where nearly the entire os temporale became necrotic and was expelled, was reported by Pomeroy in the Transactions of the American Otological Society for 1874.

As nine out of ten polypi originate from the tympanum, they were only given a passing notice among the diseases of the meatus, but are treated extensively here. Of the different methods of treatment that of abscission by the snare is considered the most effective. In one case he injected liq. ferr. sesq. chlor. when a severe reactiou followed, with headache, dizziness, and vomiting.

Otalgia tympanica.—As one of the most frequent causes is mentioned caries of the teeth, and subsequent irritation of the third branch of the trigeminus. Against pure otalgia, and also against the pains in inflammation, he prescribes iodide of potash, 1 to 30, a tablespoonful three times daily.

Facial paralysis generally causes a diminished acuity of hearing, but in some cases hyperacusis. The latter has been explained sometimes as depending upon a loose connection of the stapes-plate with the oval window, as the m. stapedius was paralyzed. But if this were so, the increased action of the m. tensor tympani would retract the membrana tympani and ossicles, and thereby press the stapes-plate deeper in the fenestra ovalis, that is, make it more immovable. From the fact that hyperacusis occurs mostly with purely peripherical, rheumatic paralysis, where there is no reason to assume that the paralysis extends to the point of descent of the m. stapedius, Urbantschitsch believes that this symptom rather depends upon an increased action of the m. stapedius. In peripherical paralysis some of the branches, like the n. stapedius, might not be paralyzed, and would answer with greater force to any impulse. Hyperacusis is, therefore, the expression of au increased function of the n. stapedius.

Among the diseases of the ossicles of hearing no mention is made of the exceptional cases of fracture of the manubrium, one of which, reported by Weir, is described by Roosa. The last part of this chapter contains the diseases of the muscles of the tympanic cavity, and gives the history and different methods of tenotomy of the tensor tympani muscle.

Chapter VI.—*Pars Mastoidea.*—Important for diagnosis is the examination of the surface of the bone with a probe, after incision, which in some cases of supposed periostitis will show the focus of inflammation to be outside the periosteum, while in other cases it may reveal subperiosteal inflammation, with separation of the periosteum. Auscultation of the processus mastoideus for diagnosis is unreliable, on account of the different anatomical variations, especially in regard to the pneumaticity of this bone, as proved by Zucker-

kandl. In treatment of caries and necrosis in children the expectative and simply disinfectant treatment is spoken of as having given surprisingly favorable results. The perforation of the pars mastoidea is according to Schwartze's method, who "of all colleagues now possesses the greatest practical experience in regard to this operation." According to this author recovery takes place in old cases within nine or ten months, in recent cases within six or seven months. As extreme limits are mentioned one month and two years. In the Transactions of the American Otological Society for 1879, Knapp reports a case of recovery in four weeks.

CHAPTER VII.—*Internal Ear; Labyrinth and Nervus Acusticus.*—The first ten pages of this chapter are devoted to development and anatomy of the internal ear and the nervus acusticus, with several illustrations, among others, of the nuclei of the nerve, as hitherto established, within the medulla oblongata. Helmholtz's hypothesis that the excitation of the nervus vestibuli created perception of noises, and that of the nervus cochlearis of rhythmic sound waves, has been revoked by Helmholtz himself, since Exner proved that even in noises the perception of pitch exists. The canales semicirculares are stated to be the organs for equilibrium, as proved by the experiments of Flourens, Breuer, Goltz, and others. The cochlea is the organ for sound perception. The perception of sounds of very little intensity is, according to Urbantschitsch, irregular, and can sometimes entirely disappear, notwithstanding the continuation of the sounds. This intermittent sound perception is considered to be analogous to the disappearance and reappearance of feeble posthumous images. As the sensorial centre for the perception is stated the first temporal convolution at the convexity of the cerebrum, according to Wernicke and Ferrier. Hyperæmia of the internal ear can be produced by disturbances in the circulation in diseases of the heart and lungs, and by an obstacle in the reflux of venous blood from the head, as in tumors of the neck (struma), strangulation, etc. Thrombosis of the sin. petr., superior or inferior, or of the vena jugularis interna, must also lead to a passive hyperæmia in the labyrinth. In necrosis, on account of the close connection between the nervus facialis and the labyrinth, the former is always implicated in the inflammatory process, or can be mechanically injured by exfoliation of the cochlea. This explains why this is always accompanied by paresis of the nervus facialis, which can be either temporary from pressure or permanent from destruction. Besides the cases of sarcoma of the nervus acusticus observed by Förster, Voltolini, and Moos, another case was reported by Stevens in the Archives of Ophthalmology, viii., p. 171.

As a secondary affection of the nervus acusticus is described the condition caused by continued intra-auricular pressure. The pressure exerted by the stapes-plate upon the labyrinthine fluid, in cases of retraction of the conductive apparatus, can gradually cause a permanent change in the acoustic organ. This may explain the decreasing perception for air and bone conduction, and

the diminished intensity of subjective noises, with increased deafness, when the function of the acoustic nerve gradually fades away.

Affection of central fibres of acoustic nerve.—The author has observed in two cases of acute hydrocephalus short attacks of temporary deafness or blindness. Typhus and scarlet fever can produce deafness and subjective perceptions, with apparently normal organs of hearing and normal central nerve-system. Syphilis, anæmia, chlorosis, and some medicaments can cause an affection of the acoustic centres, and a common cause is hysteria. In unilateral anæsthesia, paralysis, etc., it sometimes occurs that, through the influence of certain stimuli, the morbid symptoms are transferred from one side to the other. This applies also to anæsthesia acustica and optica. Urbantschitsch saw this symptom occur for the second and third time, though with decreasing intensity and with short intervals after one application of the stimulus.

Anæsthesia acustica can be incomplete or complete, and sometimes partial, either for noises or for the voice. In partial deafness for tones he assumes a partial disease of the acoustic fibres, or an affection of the fibres which terminate in that part of Corti's organ which perceives the respective tone. Paracusis duplicata is explained according to Knapp. Politzer has observed that in unilateral hardness of hearing obstruction of the healthy ear with the finger produces a noise in the affected ear. This symptom, as Urbantschitsch maintains, cannot be ascribed to the influence of the obstruction directly, but by this obstruction of the healthy ear the patient is placed somewhat under similar circumstances as during the stillness of night, when the noises, already present, are perceived more effectually. Subjective noises are but rarely the only symptoms of an affection of the acoustic nerve; sooner or later they are generally followed by anæsthesia acustica. A sudden appearance of intense subjective noises indicates a central affection or a disease of the cochlea. Subjective perception of human voices leads to suspicion of mental aberration.

In disturbances in the semicircular canals it is observed that the more rapidly an influence acts upon these canals, or the more rapidly an increase of intra-auricular pressure takes place, as in sudden copious exudation in the cavum tympani, the more intense will the symptoms of dizziness be; while conversely in chronic inflammation of the labyrinth and a slowly increasing intralabyrinthine pressure, the equilibrium may be preserved. This latter fact explains partly the preservation of the equipoise after exfoliation of the canals.

Ménière's disease must always be regarded as a sign of disease of the nervus acusticus, whether primary or secondary, especially of its peripherical terminations in the labyrinth. Meningitis cerebro-spinalis is classed as a cause of deafness, disturbed equilibrium, and vomiting. Voltolini assumes in these cases a primary inflammation of the labyrinth, because the absence of other paralytic symptoms, especially in the domain of the facial nerve, which runs in company with the acoustic nerve, proves that the trouble cannot be located in the brain. He believes it could hardly be expected that the meningeal

exudation should single out the acoustic and not the facial nerve; neither could the disease be placed in the medulla oblongata, where the nuclei of different cerebral nerves lie in close connection and are but indifferently defined. The result in recovery, so common in these cases, also speaks against meningitis. Against these assertions the author, as we believe, justly observes that this common favorable result is not yet sufficiently proven, and that the cases of this kind which come under the care of the otologist are those whose life was saved, while an indefinite number had died. Again, experience has taught that cerebro-spinal meningitis is by no means always fatal, but can terminate in complete or incomplete recovery. To this latter belongs the termination in amaurosis, in amaurosis and deafness, or deafness alone. Like the blindness caused by meningitis, the deafness is often bilateral, and can gradually diminish. A differential diagnosis between affection of the cerebellum and of the semicircular canals, and between primary and secondary affection of the labyrinth, follows. The prognosis is unfavorable in inherited or congenital anæsthesia acustica; but the deafness and subjective symptoms depending upon medicines, and the Ménière's symptoms caused by hyperæmia cerebri, hysteria, syphiloma, etc., can disappear. For treatment, the application of the constant current is especially advised. Brenner's theory and his normal formula for the galvanic acoustic reaction are extensively treated, also Benedict's method of galvanization of the sympathetic nerve, and Schwartze's objection to the value of Brenner's formula, that a healthy acoustic nerve does not always give the normal formula, and that conversely a change from abnormal to normal galvanic reaction can occur without the slightest improvement in hearing. Six pages are devoted to congenital deafness and deafness of children and deafmutism. The influence of heredity and consanguineous marriages is well brought forward. Some statistics are given in regard to geographical distribution of deafmutism, and a constant and methodical use of the ear-trumpet in children's deafness advised, to prevent forgetting to speak. The last twenty pages treat of diseases of the ear from a medico-forensic standpoint, and in regard to life insurance.

It has been the endeavor in this review to bring out the most striking parts of the work, and these are certainly the author's original views upon different points. It now remains to say that all through the book is shown the aim at completeness, and that the author has not only given the results of his large experience, but has liberally used the literature of the subject. The execution of the work is good, and references in margin make the finding of any special part quite easy. A few orthographic and other mistakes, like sulph. zinz, in place of sulph. zinc, in different places, and liq. ferri sesq. solut. in place of liq. ferri sesq. chlorate (p. 400), have not been corrected. Interspersed everywhere is a large but not cumbrous casuistic, which makes the reading very pleasant, and we heartily recommend the perusal of the work to otologists and students as one of the best.

J. J. B. Vermyne.

Quelques considérations sur l'otorrhée sans lésions osseuses et sur son traitement. Thèse pour le doctorat en médecine, 28th April, 1880, Faculté de médecine de Paris. Par Albert Brisson.

The only originality in this thesis—or rather the novel point—is contained in the chapter on treatment. The candidate gives the prescriptions used by Dr. Boucheron, whose clinic he seems to have studiously followed.

It seems that great success in uncomplicated cases has followed the use of the following:

℞. Alum sulphate,
Chloral hydrat......................aa 5 grammes.
Aquæ destill........................ 100 "

It is supposed that the sedative properties of the chloral hydrate exercise a beneficial effect on the ulcerated spots. For the throat-diseases, often accompanying otorrhœa, it has been found in the experience of the aforesaid clinic that the following is of great value:

℞. Potassii iodidi..................0.50 centigrammes.
Iodini tinct...................... 5 grammes.
Aquæ destill...................... 10 "

This, like the other prescription, must be modified according to the sensibility of the patient, age, etc.

The conclusions of the thesis are:

1. Otorrhœa abandoned to itself persists indefinitely just as certain serous inflammations do, especially of the pleura, because otorrhœa has its seat in the lining membrane of the tympanic cavity, which resembles, in its pathological states, those of serous structures and hence the necessity of local treatment.

2. Otorrhœa or purulent catarrh of the tympanum comes on consecutively to an intense catarrh of the nasopharyngeal mucous membrane, which latter is propagated through the Eustachian tube to the drum-cavity. The purulent discharge which ensues after the rupture of the drum-membrane, constitutes the otorrhœa. Acute exacerbations of the chronic nasopharyngeal catarrh may induce, after the healing of the otorrhœa, relapses of the same in the former manner, viz.: by an inflammation of the Eustachian tube extending to the drum-cavity.

3. Chronic nasopharyngeal catarrh, which by exacerbations may give rise to otorrhœa, is generally dependent upon a constitutional taint, as scrofula, lymphadenitis, the arthritic taint, herpes, tuberculosis, and syphilis.

4. Treatment has for its object:

a. Modification of the local condition of the mucous membrane of the drum-cavity, by filling the ear five times daily with the solution already named, the efficacy of which, the candidate thinks, he has seen and shown in the cases cited in his thesis.

b. Local treatment of the nasopharyngeal mucous membrane, in order to prevent recurrence of catarrh.

c. Finally, constitutional treatment of the patient, or a stricter hygiene plays a great part in the successful management of such cases.

THE INDEX CATALOGUE OF THE LIBRARY OF THE SURGEON-GENERAL'S OFFICE, U. S. A. Vol. I., (A. to Berlinski). Government Printing Office, Washington, 1880.

WHEN the war of the rebellion closed in 1865, the medical department of the army found itself in possession of a vast collection of medical and surgical specimens, the result of the labors of the medical staff of an immense army, that for five years had been in active service. When the well-directed efforts of the officers of the surgeon-general's office had created out of these specimens a wonderful museum, the time had come when a medical library worthy of the name should be collected. The importance of founding an adequate library was, fortunately, fully recognized by Dr. Billings, who was entrusted with the work. His faithful efforts have brought together a valuable collection, which will always be a monument to his intelligence and devotion to his profession. The library is now not only the largest, but the best selected of its kind in existence. It is well known to be most complete in periodical and monographical literature. Only those who have recently made search for the earlier medical literature of our own country know into how many dusty nooks and garrets Dr. Billings must have gone to find these precious documents; but as a reward for this labor he has the satisfaction of knowing that only one other library—that of the New York Academy of Medicine—approaches in completeness, in American periodical literature, the one he has brought together. In looking upon the volume before us, therefore, we should not be unmindful of the work of the past fifteen years that has made this valuable index a necessity.

It is impossible to overestimate the value to the profession of the facilities afforded them by the system of indexing the literature of medicine as exemplified in the work under notice, for without such aid the collected literature of medicine is almost inaccessible to either readers or writers. The time has come when every medical author must feel that much of his literary work may prove to be a fruitless repetition of what other writers have done before him, unless he diligently consults an index of medical literature; and any exhaustive research may now even include the valuable records of the observations of the fathers in medicine. These old authors are well worth greater attention than it is the fashion these days to give them—the older literature having been, it is to be feared, most unwisely permitted to remain for so great a period of time in disuse that it no longer commands the respect to which it is entitled by its merits.

Space will not permit, us to give here the details of the method of indexing adopted in this work; this may be said of it, however, that it gives the title of every subject treated of in the works in the library of the surgeon-general's office, also the names of the authors of the same, alphabetically arranged, the cross references making it easy to quickly refer to any particular subject. The volume has 888 pages, the index includes 9,090 author-titles, representing 8,031 volumes and 6,398 pamphlets. It also includes 9,000 subject-titles of separate books and pamphlets, and 34,604 titles of articles in periodicals. Dr. Billings acknowledges the valuable aid rendered in the preparation of the volume by Dr. Robert Fletcher; and he was aided very much in getting it through the press by Drs. H. C. Yarrow and J. R. Chadwick. There yet remains eight or nine volumes to complete the work, and every physician throughout the country should use his influence with his representative in Congress to have the necessary appropriations made.

REVIEWS.

RESEARCHES UPON THE VIBRATION OF A STANDARD TUNING-FORK. (*Unterschungen über die Schwingungen einer Normalstimmgabel.*) R. KOENIG: *Wiedemann's Annalen*, No. 3, 1880, p. 394.—This paper contains a description of a new form of tonometer devised by the author, and giving remarkably accurate results, together with an account of an extended research upon the variations of pitch produced in standard tuning-forks by variations of temperature. It also considers the effect of want of exact tuning of a resonator used in connection with a fork.

The tonometer consists of a tuning-fork C (ut_1), = 128 v.s. connected with a clock, the escapement of which is so arranged as to be regulated by the tuning-fork, which takes the place of the ordinary pendulum or balance-wheel, and has its own vibratory motion kept up by the impulses received at each vibration from the escapement wheel. This form of regulator is not new, having been invented by Niaudet in 1866, and exhibited in both the Paris and Vienna Exhibitions. The clock has three dials. The first of these has 128 divisions, and its hand makes one revolution for each 128 vibrations (single) of the tuning-fork, *i. e.*, one in each second when the fork is exactly regulated. The other dials give seconds, minutes, and hours, like an ordinary chronometer. The vibratory motion of the fork is in no way disturbed by its connection with the clock-work. The fork carries on each prong a micrometer screw with a heavy head, by which an extremely exact adjustment of the rate of the fork can be made. One of the prongs also carries the objective of a microscope, whose body, with the eye-piece, is fixed directly behind to the heavy upright frame of the apparatus, so as to constitute a Lissajous' Comparator (Vibration-Microscope). To the opposite prong a steel mirror is attached, whose weight balances that of the objective. A thermometer, hanging between the prongs of the fork, with its bulb near the stem, gives the temperature of the air surrounding the fork.

If the clock is set in operation, a perfectly isochronous vibration of invariable amplitude is kept up for an indefinite time. The vibration of any other sounding body can easily be compared with this by the optical method, making use of the attached vibration-microscope, while the exact rate of the tonometer-fork is given by a simple comparison of the tonometer-clock with a well regulated chronometer. Thus, if the tonometer-clock goes with exact correct-

ness for one hour, the fork in that time makes 3600x128=460,800 v.s., and hence 128 v.s. per second. If, however, it has gained or lost one second in that time, the rate of the fork has changed by $\frac{128}{3600} = 0.0355$ v.s.

If the fork is previously regulated for a particular temperature, as shown by exact coincidence of the rate of the tonometer-clock with that of a chronometer, any change in the rate of the clock from varying temperature will measure the effect of this change in the rate of vibration of the fork. It must be recollected, however, that the true temperature of the fork will not necessarily be exactly that given by the attached thermometer, since the former requires a much longer time to acquire the temperature of the surrounding air than the latter.

It being an important matter to know the amount of this difference, Koenig made the following determinations: Two $\bar{c}$ (ut_3) tuning-forks (512 v.s.) were brought to exact unison by comparison with a vibration-microscope, and after heating one of them the change of rate of vibration was observed, using the method of beats between the ut_3 forks as long as these were plainly audible, and then making use of the vibration-microscope.

The fork $\bar{c}$ was heated until its pitch was lowered by four single vibrations per second. The lowering after successive intervals of time was as follows:

After $5\frac{1}{2}$	minutes,	2.000	v.s.
" 12	"	1.000	"
" 25	"	0.500	"
" 37	"	0.250	"
" 50	"	0.133	"
" 60	"	0.080	"
" 70	"	0.054	"
" 80	"	0.039	"
" 100	"	0.016	"
" 120	"	0.002	"

In from ten to twenty minutes later the forks were found by optical comparison to be again in perfect unison. The fork therefore required between two hours and two and one-half hours to return to the temperature of the surrounding air, after the change in temperature to which it had been subjected.

A fork heated to the extent of lowering its pitch by 0.5 v.s., by holding it in the hand for about a minute, returns to its normal rate sooner in proportion to the change of temperature, probably because the temperature has not changed so considerably in the interior of the fork as in the former case. This also explains the observed fact, of which instances are given in the paper, that the change of rate of the tonometer-fork, after a slight change of temperature of several hours continuance, persists much longer than would be expected from the preceding experiments. It is also clear from this that the thermometer attached to the apparatus can only be considered as giving the correct tempera-

ture of the fork when the temperature of the room has remained unchanged for some hours, as shown by the constancy of the rate of the tonometer-clock.

From the fact that in the cold season experiments must generally be conducted in an artifically-heated room, Koenig concludes that it is best to choose a temperature somewhat higher than the mean temperature of Paris, as a standard temperature for forks, and hence decides upon 20° C. The experiments described in the paper were made in a large room in which the temperature was so constant that the rate of the tonometer-clock was very nearly constant from morning to night.

The question is also considered, whether the influence of the long-continued vibration of the fork itself upon its temperature is not sufficiently sensible to be considered. This influence Koenig finds to be extremely small, so that among all his researches he has noticed it on but two occasions, the circumstances of which he describes in the paper. In general, this influence is entirely masked by the slightest change of external temperature.

When the tonometer-fork was tuned to correctness at 20° C., and this temperature preserved, the accordance of the tonometer-clock with a chronometer was found to be perfect; this was repeatedly observed to be the case during several successive months. When the *mean* temperature was 20°, the rate during the time for which the mean was taken remained unchanged. One very striking instance of this is discussed in detail, and illustrates the extreme accuracy of the tuning, as well as the value of the tonometer in researches where constancy of rate and exact knowledge of its value are essential.

With the fork thus accurately tuned to 128 v.s. per second, a C_3 fork (512 v.s.) was adjusted to give the exact double octave of the former. This being compared with the former fork by the method of the vibration-microscope, its rate was found to remain absolutely unchanged as the amplitude diminished, for though the optical figure due to the combination of vibrations (1:4) was plainly visible for eighty or ninety seconds, not the least change in its form could be detected. This observation is exceedingly important, as showing that with forks whose prongs are *parallel* the vibrations are isochronous as long as the sound continues. Were this not the case, estimations either by the method of beats or by the optical method would be inaccurate, as the relation of the pitches compared would not be constant. This isochronism is not perfect when the prongs of the fork either converge or diverge instead of being parallel.

The influence of a resonating-box or a brass resonator upon the pitch of the fork is next considered. The box is shown to influence the rate of vibration of the fork when it is sufficiently in tune to sensibly reinforce the sound, and yet is not in exact unison. Thus Koenig observed that a fork mounted on a box and giving, when observed with the vibration-microscope, a cycle of the optical figure in twenty seconds, the mouth of the box being open, was altered

in rate so as to complete the cycle in twelve seconds when the mouth was covered, corresponding to a change of 0.033 v.s. per second.

More extended experiments were tried with a brass resonator. The fork used was a C_3 (512 v.s.) firmly mounted upon an iron plate, and furnished with a cylindrical resonater of brass. The pitch of the cavity could be varied by altering the length of the cylinder by means of a movable diaphragm, which closed the end farthest from the fork. Sounded without the resonator, the fork gave a note which was clearly perceptible for ninety seconds. When sounded before the resonator, this time diminished as the resonator approached to unison with the fork, the rate of vibration of the fork also changing, as was shown by the vibration-microscope. The results are given in the following table.

The first column gives the pitch of the fork, the second that of the resonator, which varied from *a* to *d*♯; the third column gives the duration of the tone in seconds, and the last the change in rate of the fork.

Pitch of Fork.	Pitch of Resonator.	Duration of Tone.	Change of Pitch.
$\bar{c}$	*a*	80	+ 0.011 v.s.
"	*ais*	60	+ 0.017 "
"	*b*	30	+ 0.033 "
"	496 *v.s.*	20	+ 0.071 "
"	*c*	8—10	0 "
"	528 *v.s.*	18	− 0.071 "
"	*cis*	22	− 0.058 "
"	*d*	45	− 0.030 "
"	*dis*	70	− 0.017 "

It will be seen that the direction of the change of rate of the fork, as indicated by the algebraic sign, is opposed to that of the resonator. Also, that the influence of the resonator, which is very slight when the difference is a minor third, increases until it reaches a maximum, when the pitch of the resonator is a little removed from exact unison with the fork, and disappears when the unison is perfect.

Dr. Koenig next considers the effect of change of temperature on the rate of the fork. A series of between 300 and 400 sets of observations was made, some of them extending over several days and nights, but the readings during the night being few in number, the rate of the tonometer-clock during the day only was used in the final consideration of the results. After excluding those cases in which the mean temperature during the observation differed less

than 1° C from the standard temperature, 20° C, the remainder were divided into two groups. In one of these, comprehending fourteen series of observations, the mean temperature of each series was at or above 21° C, the extreme values being 21° and 26.1°; in the other, comprising thirty-four series, the mean temperature was under 19° C, the extreme values being 3.1° and 17°. The separate results are given in full in a table, from which the following results are obtained.

The influence on the rate of the fork of a change of temperature of 1° C is, as deduced from the first group of observations (those having a mean temperature above 21°), 0.400 seconds per hour; according to the second group, at mean temperature below 19°, the change is 0.404 seconds per hour; while the mean change, taking into account both groups collectively, is 0.403 seconds per hour. As a change of rate of 1 second per hour in the clock corresponds to a change of rate in the fork of $\frac{128}{3600}=0.0356$ v.s., the change of rate of the fork per degree centigrade is $0.0356 \times 0.403=0.0143$ v.s.

To determine the effect of a greater extent of temperature difference, experiments were made upon forks of 128 v.s., similar in form to that of the tonometer-clock, and also upon forks of 512 v.s. One fork was inclosed in a box, the temperature of which could be raised by means of a gas-burner, while the other was kept at the temperature of the room outside. The two were compared by the optical method. From the results obtained, Koenig concludes that practically, at least up to a temperature of 50° or 60° C, the influence of change of temperature on the rate of vibration of a fork may be considered as constant and proportional to the change of temperature, though when the temperature is considerably elevated, the influence tends to diminish.

A comparison of the change of rate of forks of the same pitch, but of different dimensions, shows that in all cases the forks whose prongs had the greatest breadth and thickness were most strongly influenced by change of temperature. This was noticed both in the case of forks compared by heating together in the box before-mentioned, and also when the forks were cooled in ice-water or heated in boiling water, and compared under these circumstances. It was also noticed that on removal from the heated box in which they were placed during the progress of the experiment, the relative pitch of the forks changed, on account of the more rapid cooling of the thinner fork.

It appears from these results that the influence of a rise of temperature in diminishing the number of vibrations of a fork by lowering the elasticity of the steel is greater than the similar tendency caused by the linear expansion of the prongs.

It follows that tuning-forks of different relative dimensions, if tuned at any particular temperature, will not remain so if a change of temperature occurs. Nevertheless, unless the shapes are very different, the change even for a temperature-difference of 10° or 12° C is so small as to be negligible in all ordinary cases.

It may also be assumed that in general the change of pitch produced by change of temperature is proportional to the number of vibrations of the fork. Since, for the fork of the tenometer C=128 v.s., the change per degree centigrade is 0.0143 v.s., we may say that the period of vibration of a fork is altered by $\frac{1}{8943}$ of its amount for each degree of change of temperature; hence the change in pitch of the normal fork, $Ut_3=512$ v.s. at 20°, by a change of temperature of 1° C is 0.0572 v.s.

The standard fork, $C_3=512$ v.s., hitherto used by Koenig, when compared with the tonometer-clock, was found at 20° C to make 512.3548 v.s. per second. Hence, it would make exactly 512 vibrations at $20° + \frac{0.3548°}{0.0572} = 26.2°$ C. This computed result was verified by direct comparison of a fork tuned from the old standard with one tuned from the new tenometer, the two forks being in exact tune when the former fork was at a temperature from 6° to 6.5° higher than the latter.

The exact rate of vibration of any fork at any ordinary temperature can readily be computed from the preceding data; but, to avoid the labor of calculation, Koenig has constructed a fork which can be adjusted so as to give exactly 512 v.s. at any temperature between 5° and 35° C. An adjustable screw, carrying a weight, is attached to each prong of the fork. A half-revolution of this changes the rate of the fork from 511.142 v.s. to 512.858 v.s. at 20° C. With the weight in its extreme position nearest the end of the prong, the fork makes 511.142 v.s. at 20°, and hence the temperature must be lowered by 15°, *i.e.*, to 5°, that with the weight in this position the fork may make 512 v.s. per second. If the weight occupies its other extreme position, the number of vibrations is 512.858 per second, and the temperature must rise 15°, *i.e.*, to 35° C, that exactly 512 vibrations per second may be made.

On the circumference of the screw-head is marked the position in which it must be set to give exactly 512 v.s. at any particular temperature between 5° and 35° C.

The author next explains a simple method of constructing a fork of 870 v.s. at 15° C, the French Normal Diapason, and states as the result of a comparison of such a fork with the actual standard fork at the *Conservatoire*, that the latter gives, at 15° C, 870.9 v.s., and that it will give exactly 870 v.s. at 21.26° C. These results are not, however, to be considered as accurate as the preceding results given in the paper, owing to the difficulty of comparison with the standard normal fork, which is badly mounted, and does not remain in vibration for a sufficiently long time.

In conclusion, Koenig gives the results of various experimenters who have determined the pitch of forks constructed by him. For convenience of reference, these results are here given in full. Prof. A. M. Mayer, using the graphical method, finds $Ut_3=255.96$ v.d. at 60° F., as a mean of six experiments, the extreme values being 255.94 and 256.2 v.d. The influence of temperature he finds to be $\frac{1}{22000}$ per degree Fahrenheit (*American Journal of Science*, August,

1877). Dr. R. C. Cooley (*Journal of Franklin Institute*, September, 1877), with his electric register, finds in fifteen experiments, $Ut_3=256$ v.d. Lord Rayleigh (*Nature*, January, 1879, p. 275), using a harmonium, obtains for Ut_1 63.98 v.d. to 64.06 v.d. McLeod and Clarke (*Proceedings of the Cambridge Phil. Soc.*, December, 1877), by the use of their cycloscope, find $Ut_3=256.281$ to 256.287 v.d., with an influence of temperature change amounting to 0.011 per cent. per degree centigrade.

The paper is concluded by a brief reference to the origin of the error of Preyer and others as to the accuracy of the tuning of Koenig's forks.

C. R. Cross.

Notes of Observations on Musical Beats. A. J. Ellis. Paper read before Royal Society, June 17, 1880. *Abstract in Nature*, July 8, 1880.—The article contains the results of three years of observation in the study of the causes of error in Appun's reed tonometer and in the collection of materials for the author's History of Musical Pitch. In free air the number of beats between two notes is the exact difference of their number of vibrations. This was shown to be the case by the exact agreement of the forks of Scheibler's tonometer, which are tuned by beats, with the measurements of McLeod, Mayer, and Koenig. The temperature colfficient varies from .00004 to .00006 per degree Fahrenheit, being slightly different for different forks. The stability of forks is proved by the fact that the extreme forks of Scheibler's tonometer have not varied by $\frac{1}{10}$ of a vibration since 1837. Beats taking place in compressed air as in Appun's reed tonometer are accelerated by 76 in 10,000 or $\frac{3}{4}$ of one per cent. as a mean, as determined by a comparison of the reeds within and without the box with Scheibler's forks. The individual existance of partial tones, without the assistance of resonating cavities, was proved. The best mode of constructing a fork tonometer depends on the fact that a fork gives clearly defined beats with its octave, so that it is not necessary to tune an octave by the ear. Practical directions are given for the construction of a tuning-fork tonometer.

C. R. C.

Mr. A. E. Bridger—*The Lancet*, March 6, 1880—relates a case, that of a singularly robust young lady, who consulted him for a cough of some three years' standing. The cough was loud, incessant, and peculiarly "hollow." She had received every conceivable kind of treatment without obtaining the slightest relief. Her health seemed otherwise good in every particular. It occurred to Mr. Bridger to examine the ears, when he found that the right meatus contained a hard accumulation of cerumen which was removed by syringing with a weak hot alkaline solution. The cough now ceased, and the patient, when seen some weeks later, had had no return of that disagreeable symptom. No impaction of this mass of cerumen is supposed to have existed.

Experimental and Critical Contribution to the Physiology of the Semicircular Canals. (*Experimenteller und kritischer Beitrag zur Physiologie der halbkreisförmigen Kanäle.*) *Pflüger's Archiv*, Band XXI., p. 479.—Dr. Spamer, whose physiological work has hitherto been, so far as we know, of a rather speculative nature, gives us here a very painstaking set of experiments with cautious conclusions, on the semi-circular canals. We cannot see that his results mark a fresh step in our knowledge of the rather mysterious function of these organs. Breuer, who treated the subject in an abler way than any other vivisector, came to conclusions (Medicinische Jahrbücher, 1865), which, in the light of Spamer's experiments, seem, perhaps, too exactly formulated. Cyon's pretentious thesis (Paris, 1878) did nothing to advance the subject. Breuer concluded that each canal makes the animal sensible of motions or components of motion performed in its own plane, in either direction. He thought that mechanical pressure on the canals produced movements of compensation by the head in the plane of the canal touched. Spamer denies (pages 500, 572) that the head movements occur in any definite plane when a particular canal is injured. He thinks the immediate movements suggest shrinking from pain (page 564). Breuer described the curious limping or sagging towards the operated side, which pigeons exhibit at intervals for some days after the operation, as a sort of reeling from vertigo. Spamer's observations tend to show something more peculiarly muscular than this. Great awkwardness, or even paralysis of the foot of the same side, was noticed when bleeding had accompanied the operation (page 507), and "Ataxia" (pages 550, 557) at other times. Breuer's theory seems also to give no reason why it should be easier to push a bird along the ground toward the wounded side than toward the sound side. Curschmann first observed this difference in the pigeon's resistance and Spamer corroborates it (page 550). Another reason why Breuer's theory seems to Spamer unsatisfactory, is, that the effects from canal lesions are so much greater where the lesions are extensive. One should expect the normal operation of the endolymph to be as much altered by a slight as by a great lesion (page 562).[1]

[1] The Reporter may perhaps be excused for mentioning in this place some unpublished experiments begun on frogs with a view to testing Breuer's theory, which others with better eyesight may be able to complete. If a frog is placed in a bowl, and the bowl revolved to the right, the frog will compensate the felt movement by turning his head toward the left. If the bowl be tipped so that his head is raised, he depresses his nose; if his head be lowered, he elevates it. He compensates, in fact, every movement imparted to his body in a given plane, by a movement of the head in the same plane, but in the opposite direction. It is amusing to see how perfectly a frog's feeling of vertigo, after whirling, seems to correspond with our own. If we, after turning on our heel, stand still, we feel for a while as if we were whirling in the opposite direction. The frog shows after being whirled that he has the same illusion; for he immediately turns his head toward the direc-

In reading Spamer's paper one is more than ever struck by the strange abolition of the power of flight which the operated pigeons display, and puzzled to account for it. One might imagine the canals to confer that sensation of motion through space to which alone the wings, by reflex action, should respond. A special coördination of wing movements with this particular sensation would seem very natural. Galvanic irritation of the canals, moreover, called forth definite and characteristic wing movements (pages 528, 29, 31, 33, etc.). If this special connection existed, we ought (on the supposition that most of the disorders of movement which we observe in the birds are irritative and not paralytic) to find wing movements playing a preponderant part. The fact that they do not, can only be hypothetically accounted for by supposing them inhibited by the animal's will, in order to escape the augmentation of vertigo, which he feels they would produce.

The balancing on the finger which Spamer found possible after extensive destruction of the canals may have been coordinated with eye sensations or feelings in the skin of the feet. One of the most elaborate parts of Spamer's paper is his account of thermic, galvanic, and faradic irritations of the canals. These produce on the whole the same symptoms as mechanical destruction. For the details we must refer to the original memoir. Galvanizing through the head, without touching the canals, produced the same symptoms only somewhat less violent, and so did punctures of the cerebellum.

Spamer sums up his own conclusions in fourteen paragraphs. His general results are that the canals form a peripheral sense organ for the purposes of equilibration and have nothing to do with hearing, but that no completely satisfactory account of their mode of operation can yet be given. He himself, in the theoretic part of his text, seems at one time to lean toward the notion of their being intended to inform us of the position of the two halves of our body, including head and limbs, respectively (p. 559, etc.). But later he seems to come over to the view of Mach, Breuer, and others, that they are simple organs of vertiginous feeling (p. 583).

He agrees that almost all the phenomena produced by canal excisions are facts of excessive irritation rather than of loss of function. Loss of function, however, shows itself in the slight uncertainty of movement which the birds exhibit between the subsidence of the first irritative effects (turning in circle, tumbling about when excited, etc.) and the arisal of the much graver terminal

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tion in which he was whirling before he was stopped. If Breuer's theory were right it should seem to follow that frogs whose canals were destroyed on both sides in the same plane, either the two horizontals, or one frontal and one sagital, ought to have lost their sensibility to rotations and tiltings in that plane, and consequently ought to show no compensating movements. On twenty-one frogs, however, which were operated upon, no constant or regular behavior in this regard was observed.

phenomena connected with distortion of the neck and swinging of the head. These latter effects have an intermittent and convulsive character, and result from the extension to the central organs of the morbid process.

It seems, now, that pigeons have been vivisected by so many careful observers, as if little more light were to be thrown by their actions upon the semi-circular canal function. But what new animal or what new method is to succeed better, cannot easily be divined. It seems unlikely, however, that any further experiments will reverse the conclusion already certain that the canals are in some way or other peripheral organs for the feeling of translation in space. They will only clear up the details of their *modus operandi.*

W. James.

On Tones Produced by a Limited Number of Impulses. (*Ueber Töne, die durch eine begrenzte Anzahl von Impulsen erzeugt werden.*) W. Kohlrausch, *Wiedemann's Annalen*, 1880, No. 5.—The author has sought to determine the least number of vibrations capable of producing a musical sound, and also the effect of a varying total number of impulses upon an exact estimation of the pitch. This latter question was studied by finding the interval at which the sound produced by a limited number of impulses was recognized as clearly distinct in pitch from a second note which could be varied at will by a known amount.

The apparatus used was a pendulum to which was attached a portion of a toothed wheel, the radius of this wheel being equal to the length of the pendulum. The pendulum was raised through a certain arc, and allowed to fall so that the teeth of the wheel should strike against a card placed underneath it. By varying the number of teeth, their distance, and the arc of oscillation of the pendulum, all needed changes could be made, so that the pitch of the note and the total number of impulses producing it could be fixed at will. The tone with which this sound was compared was given by a monochord, and could easily be varied by as small an amount as was desired. The velocity of the pendulum could be calculated from the pitch of the note produced and the number of teeth, from the arc of oscillation, or it could be measured by a Hipp's chronoscope. The measurements were made so as to determine, first, the interval by which the tone of the monochord had to be raised in order to be of a distinctly higher pitch from the note produced by the teeth, and, second, the interval by which the note of the monochord had to be lowered before it was recognized as of a distinctly lower pitch. These intervals were of course calculated from the variation given to the length of the sounding portion of the string, suitable means being adopted to avoid errors from rigidity, etc. The interval between these extremes, that is, the sum of the two intervals measured, is called by the author the "characteristic interval," and was determined for different pitches and different numbers of impulses. The variations for the different pitches used were slight. A table exhibiting the results of a

large number of experiments, in which the number of teeth varied from 2 to 16, and the absolute pitch of the note produced from 81.4 to 244.2 vibrations. The following figures taken from this table give the mean characteristic interval with different numbers of impulses.

No. of Teeth.	Interval.	No. of Teeth.	Interval.
2	0.9714	10	0.9906
3	0.9790	11	0.9909
4	0.9821	12	0.9906
5	0.9853	13	0.9914
6	0.9871	14	0.9913
7	0.9883	15	0.9916
8	0.9897	16	0.9922
9	0.9903		

The author compares the results of his experiments with deductions from Helmholtz's theory of the co-vibration of portions of the inner ear, and finds a close agreement. Besides this it follows from the research that a sound produced by but two vibrations can be detected as different in pitch from another when the interval between the two is $\frac{24}{25}$, and that as Exner and Auerbach have previously found, for an ear of ordinary delicacy, the pitch of a note does not become any more definitely marked after a limit of sixteen impulses is reached.

C. R. C.

New Audiphone. Fletcher. *Nature*, June 17, 1880.—A sheet of stiff wrapping paper 11 × 15 inches, is folded with its ends together, so as to form a loop in the middle, and the ends are placed between the teeth.

Dry Treatment of Otitis Media Purulenta.—A paper on this subject by Dr. Spencer, published in the July number of this journal, was the occasion of some interesting remarks on the subject by Dr. Todd, before the St. Louis Medico-Chirurgical Society. *St. Louis Courier of Medicine*, August, 1880. Dr. Todd has given the dry treatment a fair trial, and consequently has almost ceased giving ear drops to patients. He alluded to the danger of injuring the ear by the methods now in fashion. The practice had formerly consisted in letting the discharge continue without attempting to interrupt its progress, now the danger consisted in the multiplicity of washes to which the ear is subject. The first thing that strikes one on looking into a suppurating ear is the macerated condition of the parts, and the treatment should be to overcome this, not to increase it by washings. Dr. Todd seeks to obtain this drying effect mainly by the insufflation of powdered borax, having previously wiped the parts with absorbent cotton-wool, cleansing with water only once and a while, as the case may demand.

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Upon the Production of Sound by Light. Alexander Graham Bell and Wm. Tainter.

Lecture Experiment for the Direct Determination of the Velocity of Sound. W. A. Anthony.

On the Musical Pitch at Present in Use in Boston and Vicinity. C. R. Cross.

An Investigation of the Vibration of Plates Vibrated at the Centre. Thomas R. Baker.

The Topophone: an Instrument to Determine the Direction and Position of a Source of Sound, with an Account of the Application of this Instrument to Scientific Investigation. A. M. Mayer.

Phonophobia and the Influence of Noise on the health of Dwellers in Cities. Clarence J. Blake.

A Standard Logograph. Clarence J. Blake.

The following note received is presented to the favorable consideration of the readers of this JOURNAL:

NEW YORK, 41 WEST TWENTIETH STREET, July 31, 1880.

Editor of AMERICAN JOURNAL OF OTOLOGY:

DEAR SIR:—Having been selected by the Paris Committee (Messrs. Ranvier and Dumontpallier) having charge of the subscription for a monument or memorial to the late Prof. Claude Bernard, to represent them in the United States—I beg leave to be allowed to use your columns for the purpose of appealing to the members of the medical profession and all others interested, to subscribe to this worthy project.

I need hardly remind your readers of the great debt which every practicing physician owes to the labors of the illustrious physiologist whose memory we are asked to honor in this way.

All inquiries and subscriptions, in the shape of bank checks or postal money-orders, should be addressed to me.

Trusting that I shall have the advantage of your active personal support in this matter, I remain,

Yours, very respectfully,

E. C. SEGUIN, M.D.

THE seventh session of the International Medical Congress is announced to be held in London in 1881, opening with a reception of welcome on the evening of August 2d, and continuing in active session during the seven days following.

The officers of Section X., Diseases of the Ear, are: *President*—William B. Dalby, Esq.; *Vice-Presidents*—Dr. Cassells, Glasgow; Dr. Fitzgerald, Dublin; *Secretaries*—Dr. Urban Pritchard, Dr. Laidlaw Purves.

All communications respecting the Congress should be addressed to William MacCormac, Esq., Hon. Secretary General, 13 Harley Street, London, W.

INDEX TO VOL. II.

ABSCESS of the brain from disease of the ear, 161.
from otitis media purulenta chronica, 226.
a probable case of, following otitis media acuta purulenta, 189.
Acoustical illusion, 48.
shadow of a circular disk, 212.
Acoustics, lecture experiments in, 136.
Acuteness of hearing, different methods of determining, 62.
Acute circumscribed inflammation of the external auditory canal, the comparative value of leeches, heat, and incisions in the treatment of, 25.
Allen, James, report of a fatal case of, 239.
Allport, Frank, a case of probable abscess of the brain following otitis media purulenta acuta, 189.
American Association for the Advancement of Science, meeting of, 1880, 347.
Otological Society, thirteenth annual meeting of, 1880, 309.
Antiseptic treatment of certain diseases of the ear, 68.
aural surgery, 315.
Anderson, McCall, left facial paralysis, tumor near parotid gland, probably syphilitic, 238.
Aneurism of the middle meningeal artery from traumatism, a case of, 309.
Archives of Laryngology, a new journal, notice of, 247.
Artificial drum-heads; uninterrupted use of cotton pellets, 14.
Audiphone, new, 114, 344.
Auditory meatus, a case of closure of, by exostoses, 72.
Auditory formula of Brenner, 246.
Audiometer, 46.
Aural diseases at Halle, report of the policlinic for 1871 to 1879, 229.
report of the policlinic in Göttingen for 1879, 229.
phenomena produced by chenopodium poisoning, 292.
therapeutics, the skepticism prevalent regarding the efficacy of, 70.

BABER, E. Cresswell, on a possible source of error in the diagnosis of fungus in the ear, 66.
Baratoux, J., the relation of diseases of the ear to those of the uterus, 151.
Barr, Thomas, report of a case of abscess of the brain from disease of the ear, 161.
abscess of the brain from otitis media purulenta chronica, 226.
Beats, musical, notes of observations on, 340.
Bell, Alexander Graham, experiments relating to binaural audition, 169.
Bertholet, M., the chemical transformations in matter attributable to sonorous vibrations, 210.
Better hearing in noise, a case of, 305.
Bibliographical index, 78, 165, 243, 345.
Bigelow, Horatio R., on the chorda tympani nerve, 58.
on the anatomy and physiology of the chorda tympani nerve, 224, 239.
Billings, John S., the index medicus, 247.
index catalogue of the library of the Surgeon-General's office, U.S.A., 332.
Binaural audition, experiments relating to, 169.
Blake, Clarence J., a resonant tuning-fork, 3.
a form of middle-ear syringe, 5.
on the occurrence of exostoses within the external auditory canal in prehistoric man, 81, 295.
the membrana tympani telephone, 180.
report of case of manometric cicatrix of the membrana tympani, 201.
the auditory formula of Brenner, 246.
Blau, Louis, cases of disease of the labyrinth, 147.
Bogroff, a new method of opening the mastoid, 69.
Bone conduction, some remarks and observations on, 312.
Bonnafont, M., on certain pathological states of the tympanum which induce nervous phenomena, 161.
Book notices, 76, 120, 206, 345.
Boucheron, M., treatment of infantile deafness and deaf-mutism, 238.
Branchial fistulæ at the external ear, 311.
Brett, case of rupture of the membrana tympani by blowing the nose, 225.
Bridger, A. E., reflex cough from inspissated cerumen, 340.
Brisson, Albert, some considerations upon otorrhœa without osseous lesions, and on its treatment, 331.
British Medical Association, forty-seventh annual meeting of; proceedings of the subsection of otology, 40.
subsection of otology, 1880, 313.
Brown, T. R., report of case of chenopodium poisoning, 293.
Bruce, Alexander, the pathology of a case of fatal ear disease, 234.
Buck, Albert H., the comparative value of leeches, heat, and incisions in the treatment of acute circumscribed inflammation of the external auditory canal, 25.
unilateral patency of the Eustachian tube, 203.
fractures of the temporal bone, 264.
Bumstead, Freeman J., views on the sudden deafness from syphilis, 301.
Bürkner, K., traumatic and inflammatory affections of the middle ear, 144.
report of the policlinic for aural diseases in Göttingen for 1879, 229.
Burckhardt-Merian, report of a policlinical and private practice in Basel, 1874 to 1879, 231.
Burnett, Charles Henry, uninterrupted use of cotton pellets as artificial drum-heads, 14.
reflex ulceration in the external auditory canal, with perforation of the membrana tympani, produced by diseased teeth, 285.

CARCINOMA of the middle ear and petrous bone, 140.
Carmichael, Henry, presentation of sonorous vibrations by means of a revolving lantern, 209.
Ceruminous collection, causing chronic bronchitis, 228.
Chenopodium, a report of cases of poisoning from, 197.
poisoning, a note on the aural phenomena of, 292.
Chorda tympani nerve, 58.
anatomy and physiology of, 224, 239.
Clinical observations, 100, 201, 301.
Coggin, David, a new test for one-sided deafness, 62.
Coldefy, M., the education of deaf-mutes, 48.
Cough, reflex, from inspissated cerumen, 340
Cotton-wool dressing in otitis media purulenta chronica, 315.
Cross, Chas. R., and Wm. T. Miller, on the present condition of musical pitch in Boston and vicinity, 249.

DALBY, on syringing the ear with astringent lotions, 164.
on diseases of the mastoid bone, 227.
Deaf-mutes, education of, 48.
method of instruction of, 55.
the physiological and psychological laws governing articulate instruction of, 206.
Deeper musical tones, the ability to hear them by the partially deaf, 219.
Delstanche (fils), a new instrument for the removal of adenoid vegetations from the naso-pharynx, 69.
Dolbear, A. E., on the number of vibrations necessary for the recognition of pitch, 1.
Deprès, on the various seats of mucous patches, especially the mucous patches of the auditory canal, 60.
Duncanson, J. J. Kirk, report of a case of disease of the temporal bone, 160.

EAR, affections of inherited syphilis, 311.
Ear disease, report on the cases of, observed in the University Policlinic of Berlin, 65.
Ear, diseases of, von Dr. Victor Urbantschitsch, 317.
Edison, Thomas Alva, a resonant tuning-fork, 3.
Electricity, value of, in ear disease, 313.
Ellis, A. J., notes of observations on musical beats, 340.
Ely, Edward S., note on the treatment of acute suppurative inflammation of the middle ear, 63.
Emissary vein of the mastoid, phlebitis of, 92.
Endo- and peri-lymphatic cavities of the labyrinth and extra-labyrinthine intra-cranial cavities, communication between, 56.
Eustachian tube, unnatural patency of, 203.
Eve, Frederic S., report of a case of fracture of the skull, 240.
Exostoses, occurrence of, within the external auditory canal in prehistoric man, 81, 295.
of auditory meatus; operation, 242.

FACIAL paralysis, a case of, 100.
caused by a tumor near the parotid gland, 238.
in fractures of the temporal bone, case of, 269.
syphilitic, a case of, 302.
double, of syphilitic origin, a case of, 304.
Faradization of the nerves traversing the tympanic cavity, effects upon secretion and circulation produced by, 58.
Fatal ear disease, the pathology of a case of, 234.
Fatal case of suppurative otitis, 239.
Fletcher, new audiphone, 344.
Foreign body in the ear, producing severe cerebral symptoms; removal and recovery, 9.
in the ear, cases of, 108.
in surgery, including foreign bodies in the ear (review), 121.
in the external ear, 228.
forceps, 298.
Fractures of the temporal bone, 107, 163, 240, 241, 264.
Fractures of the base of the skull. (See fractures of the temporal bone.)
Fracture of the handle of the malleus, a case of, 67.
Fungus in the ear, on a possible source of error in the diagnosis of, 66.

GALVANO-CAUTERY and laminaria rods, use of, for the removal of exostoses and the dilatation of the meatus, 72.
Gardner-Brown, report of a case of exostosis in external auditory canal; operation, 212.
Gellé, pulsating tumors of the tympanic cavity, 76.
Gillette, otitis in a tuberculous subject: suppuration in the tympanum; trepanation of the mastoid apophysis, 138.
Glass bead in the ear, 70.
Gottstein, J., exfoliation of almost the entire temporal bone, the result of necrosis, 232.
Green, J. Orne, phlebitis of the mastoid emissary vein, from phlebitis of the lateral sinus, 92.
osteo-sclerosis of the mastoid, 310.
Gude, W., the physiological and psychological laws governing articulation in deaf-mute instruction (review), 206.

HAND-ATOMIZER, a simple modification of, 35.
Hartman, Arthur, on the washing out of the tympanic cavity and its recesses, 70.
deaf-mutism and the training of deaf-mutes (review), 126.
sclerosis of the mastoid, 225.
Hessler, Hugo, report of the policlinic for aural diseases at Halle, 1871 to 1879, 221.
Hewett, Prescott, views on fractures of the base of the skull, 280.
Holmes, E. L., objective sounds from the ears, 68.
vocal physiology and hygiene, a treatise on (review), 133.
Houdin, M., method of instructing deaf-mutes, 55.
Hospitalier, E., the audiometer, 46
Hulke, report of cases of fracture of the base of the skull, 163.

INFANTILE deafness and deaf-mutism, treatment of, 238.
Index catalogue of the library of the Surgeon-General's office, U.S.A., 332.
medicus, notice of, 247.
Institution for deaf-mutes at Passy, examination of, 55.
Intracranial disease, caused by chronic suppuration of the middle ear, 62.
Internal ear, contributions to the pathology of, 157.
International Congress of Medical Sciences; proceedings of the Section of Otology, 36.
Instrument, new, for the removal of adenoid vegetations from the naso-pharynx, 69.
for removing fluids from the tympanum, 72.

JACOBY, reports of cases of primary and secondary periostitis and ostitis of the mastoid process, 152.

KIESSELBACH, a contribution to the normal and pathological anatomy of the temporal bone, with especial regard to the temporal bone of children, 214.
Kipp, Charles J., four cases of intracranial disease caused by chronic suppuration of the middle ear, 62.
branchial fistulæ at the external ear, 311.
on the ear affections of inherited syphilis, 311.
Knapp, H.; some remarks and observations on bone conduction, 312.

König, R., researches upon the vibration of a standard tuning-fork, 334.
Kohlrausch, W., on the sensibility of the organ of hearing, 48.
 on tones produced by a limited number of impulses, 343.
Kühn, antiseptic treatment of certain diseases of the ear, 68.
Küpper, pulsation in the membrana tympani, 223.

LACHARRIÈRE, Ladre t de, the use of mineral waters in the treatment of diseases of the ear, 63.
Labyrinth, cases of disease of, 147.
Lange, Victor, the use of the nasal douche of Weber, 162.
Leeson, Rudd, chronic bronchitis from a collection of cerumen in the meatus, 228.
Life insurance, diseases of the ear bearing upon the subject of, 39.
Longhi, Giovanni, a case of Ménière's disease, 61.
Lucæ, Aug., report on the cases of ear disease observed in the University Policlinic of Berlin, 65.
 the ability to hear the deeper musical tones by the partially deaf, 219.
Lupton, Harry, report of a case of fracture of the temporal bone, 241.
Luxation of the inferior maxilla above and into the temporal fossa, 40.

MANOMETRIC cicatrix of the membrana tympani, 201.
Mastoid, a new method of opening, 69.
 process, cases of severe disease of, 73.
 trepanation of, 138.
 process, cases of primary and secondary periostitis and ostitis of, 152.
 sclerosis of, 225.
 bone, diseases of, 227.
McBride, P., contributions to the pathology of the internal ear, 157.
 the pathology of a case of fatal ear disease, 234.
Mechanical aids to hearing, discussion of, 315.
Melted cerate poured into the meatus with a view to destroy an insect, 228.
Membrana tympani, a clinical lecture on perforating wounds and injuries of, with a case of fracture of the handle of the malleus, 67.
 telephone, 180.
 pulsation in, 223.
 rupture of by blowing the nose, 225.
Ménière's disease, 61.
 the vertigo of, 37.
Middle-ear syringe, a form of, 5.
 treatment of acute suppurative inflammation of, 63.
 a case of purulent inflammation of, 110.
 traumatic and inflammatory affections of, 144.
 dry treatment in suppuration of, 184.
Mineral waters, use of in the treatment of diseases of the ear, 63.
Miller, Wm. T., on the present condition of musical pitch in Boston and vicinity, 249.
Molest, Suñé y, celuloglobular polypus, 232.
Moos, S., a case of closure of the auditory meatus by the formation of exostoses, with acute perforative inflammation of the middle ear, 72.
 cases of severe disease of the mastoid process, 73.
Mouth-trumpet, 114.
Mosher, Eliza M., a case of purulent inflammation of the middle ear, 110.
Mucous patches, on the various seats of, especially of the auditory canal, 60.
Musical pitch, on its present condition in Boston and vicinity, 249.

NASAL douche, use of Weber's, 162.
Necrosis of petrous portion of temporal bone, with loss of cochlea, semicircular canals, etc., and facial paralysis, 100.
Neis, Paul, a case of luxation of the inferior maxilla above and into the temporal fossa, 40.
Nervous phenomena, owing to certain pathological states of the tympanum, 161.
New aural instruments, polypus snare, and foreign-body forceps, 298.
North, Alfred, two cases of poisoning by the oil of chenopodium, 197, 293.
Notes, 80, 246, 347.

OBJECTIVE sounds from the ears, 68.
Osteophytes in the temporal bone, an unusual development of, 234.
Osteosclerosis of the mastoid, 310.
Otological congress, second international meeting, 1880, 247.
Otitis in a tubercular subject, suppuration in the tympanum; trepanation of the mastoid apophysis, 138.
 media purulenta, dry treatment of, 344.
Otology, subsection of, British Medical Association, 1880, 313.
Otorrhœa, some considerations on, 331.
Oral irritation in connection with sudden deafness from syphilis, a case of, 304, 305.
Organ of hearing, on the sensibility of, 48.

PARACUSIS Willisii, discussion of, 314.
Phlebitis of the mastoid emissary vein from phlebitis of the lateral sinus, 92.
Phendophone, 47.
Pitch, on the number of vibrations necessary for the recognition of, 1.
 musical, on the present condition of in Boston and vicinity, 249.
Polaillon, M., carcinoma of the middle ear and petrous bone, 140.
Policlinical and private practice in Basel, report of, 1874 to 1879, 231.
Pole, A. C., report of a case of chenopodium poisoning, 292.
Polypus snare, 298.
 celulo-globular, 232.
Poulet, A., foreign bodies in surgery, including foreign bodies in the ear, 121.
Pritchard, Urban, a case of foreign body in the ear, producing severe cerebral symptoms; removal and recovery, 9.
Progressive deafness, 22.
Pulsating tumors of the tympanic cavity, 76.

RAYLEIGH, Lord, a new form of siren, 213.
 the acoustical shadow of a circular disk, 212.
Reflex ulceration in the external auditory canal, with perforation of the membrana tympani, produced by diseased teeth, 285.
 phenomena, excito-secretory action, 58.
Reviews, journals, 45, 136, 209, 334.
 books, 36, 120, 206, 331.
Rhus toxicodendron, a case of otitis externa acuta from poisoning of, 104.
Rood, O. N., on a method of studying the reflection of sound waves, 137.
Russell, James, report of a case of vertigo from sneezing, 164.

Schalle, an instrument for removing fluids from the tympanum, 72.
Seguin, E. C., letter requesting subscriptions to a memorial to Claude Bernard, 348.
Semicircular canals, experimental and critical contribution to the physiology of, 341.
Sexton, Samuel, hearing by the aid of tissue conduction; the mouth-trumpet and the audiphone, 144.
 tinnitus aurium, 193.
 a note on the aural phenomena produced by chenopodium poisoning, 292.
 new aural instruments, polypus snare, foreign body forceps, 298.

three cases of sudden deafness from syphilis, 301.
Shrapnell's membrane, injury in region of by fracture, 282.
Simulated one-sided deafness, a new test for, 62.
Siren, a new form of, 213.
Spamer, experimental and critical contribution to the physiology of the semicircular canals, 341.
Spear, E. D., clinical observations, 100.
Sonorous vibrations a cause of chemical transformations in matter, 210.
presentation of, by means of a revolving lantern, 209.
Sound-waves, on a method of studying the reflection of, 137.
Spencer, H. N., a case of aneurism of the middle meningeal artery from traumatism, 109.
the dry treatment in suppuration of the middle ear, 184.
Syphilis, sudden deafness from, three cases of, 301.
Syringing the ear with astringent lotions, 164.

TEETH, disease of, causing reflex ulceration in the external auditory canal, with perforation of the membrana tympani, 285.
Telephone, the membrana tympani telephone, 180.
Temporal bone, a case of fracture through glenoid fossa by a fall on the chin, 107.
a contribution to the normal and pathological anatomy of, with especial regard to the temporal bone of children, 214.
necrosis and exfoliation of, 232.
fracture of, 240, 241.
a case of disease of, 160.
fractures of, 264.
Theobald, Samuel, the skepticism prevalent regarding the efficacy of aural therapeutics. To what extent justifiable? 70.
foreign bodies in the external ear, 228.
Thompson, Prof. S., the pseudophone, 47.
Thompson, Sylvanus P., lecture experiments in acoustics, 156.
Throat-deafness associated with paresis of the palato-tubal muscles, further observations on, 22.
Tinnitus aurium, 193.
note on, 193.
Tissue conduction, hearing by the aid of: the mouth-trumpet and the audiphone, 114.
Todd, Charles A., a simple modification of the hand-atomizer, 35.
dry treatment of otitis media purulenta, 344.
Tones produced by a limited number of impulses, 343.
Troeltsch, Anton von, on the aural diseases of children (review), 120.
Tuning-fork, resonant, 3.
researches upon the vibration of, 334.
Turnbull, Charles S., a clinical lecture on perforating wounds and injuries of the membrana tympani, with a case of fracture of the handle of the malleus, 67.

URBANTSCHITSCH, Victor, work on diseases of the ear, 317.
Uterus, relation of, to diseases of the ear, 151.

VERTIGO of Ménière, 57.
produced by incessant sneezing, 164.
Voltolini, glass bead in the ear, 70.
Vulpian, A., effects upon secretion and circulation produced by faradization of the nerves traversing the tympanic cavity, 58.

WEBER-LIEL, progressive deafness, 22.
communication between the endo- and perilymphatic cavities of the labyrinth and extra-labyrinthine intra-cranial cavities, 56.
Washing out the tympanic cavity and its recesses, 70.
Woakes, Edward, further observations on "throat-deafness associated with paresis of the palato-tubal muscles," 22.

ZUCKERKANDL, E., an unusual development of osteophytes in the temporal bone, 234.